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The Street Railway Convention.

As we go to press conventions are in full swing at Columbus, Ohio, of the American Street and Interurban Railway Association, the American Street and Interurban Railway Engineering Association, the American Street and Interurban Railway Accountants' Association and the American Street and Interurban Railway Claim Agents' Association. To readers who have not followed the latest developments in the society phase of electric traction activity, we hasten to say that the above aggregation merely represents the familiar American Street Railway Association under its most recent reorganization and verbal dress. The first-mentioned association may be described as a "holding" or parent organization, the others being subsidiary organizations, to which may be added the affiliated American Street and Interurban Railway Manufacturers' Association, a semi-independent body having cognizance of entertainment and manufacturers' exhibits. Under its old title the association representing light railway traction had an enviable career, particularly during the period of transition to electric traction. It is true that the old name did not take account of the great widening of the field which the association actually represented; but on the other hand the new name does not recognize, or measure up to, the extension of electric traction to heavy railroad work, which promises in time to preponderate. While the subdivision into affiliated associations has something in its favor as a working plan, it minimizes, nevertheless, the prestige of the parent body, which once in itself represented the whole industry and art, and this without creating prestige for the associations having only a partly independent character. This is perhaps inevitable in a transition period that is carrying electric railway work to a magnitude of unexpected proportions; and it can only be hoped that in the field thus represented the federal plan of organization exemplified may be found to justify itself in useful achievement by the association as a whole.

Of the papers presented before the various associations, that by Mr. Windsor on gas engines, abstracted elsewhere, is perhaps of the widest general interest. While the application of the gas engine to electric traction work is not new, and such work does not involve any factors of importance differentiating this application from other uses in which the gas engine has won its spurs, yet the excellent results reported from Boston should have a practical effect in directing the attention of street railway managers to what many believe to be the coming prime-mover. That in ordinary street railway operation a consumption of 12 lb. of coal per kw-hour can be obtained is certainly a fact that should rivet attention. Moreover, the satisfactory report on the gas producing plant will tend to clear up many a doubt. One is easily excusable for viewing with suspicion, at first thought, the addition of a gas works to an electrical generating plant, and the experience in Boston with this part of the equipment will be reassuring. It was found that the gas producing part of the plant is simple, easier to operate and holds its efficiency better than a steam plant, has less stand by losses, and can be gotten in service much more quickly. Another point worthy of note is the relatively small size of the plants giving such satisfactory results in operation—one being of 700 kw and the other 975 kw. According to Mr. Windsor, the efficiency is unchanged

in plants as small as a couple of hundred horse-power, in this case, therefore, still further increasing its lead over the steam engine plant.

The Michigan Convention.

At the Michigan Electric Association convention last week considerable was said in an informal way about the benefits to be derived by small companies from membership in a State association. It was said by some member that in such an association the managers of the smaller companies were able to get the advantages of the advice and experience of the larger companies at but little cost, whereupon President Chandler remarked that it frequently worked the other way and that the managers of the small plants could give the big companies a good many pointers on how to conduct and develop business. This was forcibly illustrated later in the session when a member from a very small village reported a number of irons in service per capita of population about twenty-two times that of the largest city reporting on the subject, and also reported a steady day load equal to 80 per cent of the winter peak load. The owners of small plants sometimes bemoan their fate and point to the much greater opportunities in the larger cities. It is very doubtful whether the opportunities are as great in proportion to the population in large cities as in villages and towns of medium size. It is undoubtedly true that a great majority of the small companies are not doing anywhere near the amount of business they should be doing, but the most progressive of the smaller companies are probably doing a larger proportion of the possible business in a town than the companies in large cities can ever hope to do.

In the discussion on the plans and past accomplishments of the Co-operative Electrical Development Association several statements were made which will serve to clear up in the minds of central station men certain points which appear not to be generally understood. The question has often been asked just what specific things the Co-operative Association proposes to do and what it has done so far in the way of encouraging new business methods. The relation of the association to the advertising agencies now soliciting central station companies' business has been somewhat uncertain in the minds of many and perhaps has caused some to await developments rather than to act at once. The gist of the matter is, as will be seen by the convention report printed in this issue, that the association by agitating this matter among central station companies and by financial assistance to certain advertising agencies, has made it possible for these advertising companies to enter the central station field. In other words, the field was so dead before the Co-operative Electrical Development Association began the agitation that no advertising company had the nerve to enter it and do the missionary work necessary to work up a business. This, however, is only the one and the first step in a large and comprehensive plan which was reviewed in detail in the paper presented by Mr. Crouse at the National Electric Light convention.

Direct-Current Transmission for Lyons.

We are glad to be able to present an authoritative account derived from M. Thury himself of the very interesting 60,000-volt direct-current transmission from Moutier to Lyons, a distance of over 110 miles. As one of the world's long transmissions and by far the longest one yet attempted with direct current, the system deserves special attention, and it is particularly striking from the fact that the direct-current system is united to a three-phase system coming into Lyons from other points with provisions for the mutual interchange of energy. Naturally interest centers about the generating station at Moutiers, since the line presents no especial problems, while the station is of exceptional capacity. The whole power provided for on this direct-current system is 4,500 kw, delivered at a maximum full load pressure of 60,000 volts. To generate this high voltage no less than sixteen constant-current dynamos are connected in series, each with capacity for the full 75 amp. and capable of working, if need be, up to 3,900 volts. Each element is therefore of about 300 kw. Dynamically there are four groups, each of four generators, but each group is split into two pairs by an insulating coupling and each consisting of two generators on a common bed plate. A similar insulated coupling unites each water wheel to its group of generators. Each generator is insulated from earth by bolts in its base resting in cup insulators, and is surrounded by an insulating floor. The provisions for regulation are of rather striking simplicity. One motor regulator at Moutiers holds constant-current conditions for the whole station. Each wheel when started up is hand-regulated until it takes its share of the load, and the governor thereafter regulates all the wheels together. Thus handled the generating station impresses one as being by no means difficult to operate. The generating units are, it is true, small, but their connection is such as to make the complication more apparent than real.

On the way to Lyons the transmission line passes through two earthing stations, enabling earth return to be used if necessary, and then goes on to Vaulx-en-Velin, whence the transmission is underground to Lyons. At this intermediate point is a sub-station containing three pairs of machines, similar to those at Moutiers, each pair being coupled to a three-phase, 11,000-volt machine through an insulating connection. The regulator on these groups can govern for constant current when the Thury machines are generators, or for constant speed when they are motors. Three more pairs of Thury machines are in the Lyons sub-station and still two other pairs are to follow. There are many ingenious features in these plants of which details will be found in the article, but the thing which most impresses one is the very workmanlike way in which the apparent complication of the continuous-current system has been brought into subjection. It is interesting to note that earth return in case of accident to one wire seems to be entirely practicable, the resulting drop at full current being only about 200 volts, an amount practically negligible. The insulators used on the line bear witness to the practical lessening of insulation strain by the use of direct current. They are three-part porcelain affairs of dimensions which would be here considered suitable for 30,000 to 35,000 volts alternating current. An ingenious feature of the plant is the provision for increase of capacity at some future time. Each pair of generators in the station can readily be coupled with the two armatures in parallel, so that if more water power were employed the existing station could become part of a 150-amp. constant-current plant at anything up to 60,000 volts without further changes in machines or insulation. Altogether this Moutiers plant represents a great advance in simplicity over the early constant-current plants by which most engineers have known the system. M. Thury has worked for years consistently along this line, and the plants he has installed in face of alternating-current competition are evidence enough of the good features of his installations. His system certainly cannot be passed over in silence when it comes to the use of extreme voltages. Plants like the one here considered seem eminently workable, and M. Thury is assuredly to be congratulated upon the success which has again rewarded his persistent efforts

The Electric Railway Ground Return.

Each system of electric conductors employing long conductors has tried to use the ground as a return circuit, because telegraph circuits always use it. The ground has been of immense service to telegraphy. Without it we should probably have to use two telegraph wires where one was used before, or to double all telegraph lines. It is no wonder that telephony, electric lighting, and electric railroading were jealous of telegraphy on account of its free use of the earth. Telephony commenced with single-wire circuits and ground return, arguing that if the earth would carry a few centiamperes satisfactorily for telegraphists, it would not object to a few microamperes more for telephonists. But telephony, after several years of trial, had enough of the earth, and "noisy as a ground-return circuit" became a stock phrase. It is now hard to find a telephone circuit with ground return except in the remote country districts, and all telephone wires run in couples. Electric lighting in the early days of its development tried to save copper by the use of a ground return circuit, but the drop of pressure in the line was found to be small compared to the drop of pressure in the ground, so that electric lighting soon left the ground severely alone.

Finally the electric railroad made a last attempt to share the ground with telegraphy. It had volts to spare, and motors were not so sensitive as lamps to drop of pressure. Moreover, the track rails rested on the ground, which was often damp, and then in the streets not far beneath were all kinds of convenient metallic pipes to help the ground in its return transmission. Steadily and surely the railway gave up ground in despair. First, and very soon, came the necessity of bonding the track. Then came the running of bare underground copper wires under the track, connecting at intervals with the bonded rails. Then came the necessity for bare copper ground feeders. Finally it is becoming recognized as the best policy to use insulated, although not highly insulated, track feeders containing plenty of copper from the negative bus-bar of the switchboard to the track conductors. This is virtually giving the ground exclusively over to telegraphy and operating with a complete metallic return system, in which the rails merely act as the local contact between the car axles and the track conducting network. After all, when we come to think about it, the ground itself when dry is almost non-conducting. Dry soil, sand, clay and similar materials are practically insulators. Except in rare veins of pure metal, the only conductor in the ground is water, and it does not pay to attempt to use water as a conductor in electric power distribution. The above conclusions are emphasized by the arguments presented in a paper on "Underground Cables" by Mr. H. G. Stott, read this week before the Street Railway convention at Columbus. This paper advocates the use of insulated negative feeders, and avoiding all grounds in the power house. When the ground is connected to the neutral point of a high-pressure star three-phase transmission system, a resistance is advocated between neutral and ground in order to limit the flow of current in any accidental short circuit.

Eddy-Current Losses in Laminated Iron.

It is well known that the losses of power which occur in the iron cores of all dynamo-electric machines are attributable jointly to hysteresis and eddy currents. These two quantities are of a totally different nature, and follow different laws. Nevertheless, it requires special analysis to separate them, and they are usually reckoned together under the titles of "core-loss" or "iron-loss." The eddy-current loss per pound of iron core diminishes with the thickness of the laminated sheets so that theoretically the eddy-current loss might be made indefinitely small provided iron plates could be obtained indefinitely thin. The hysteretic loss per pound of iron does not vary with the thickness of the core plates. In practice, core plates are seldom less than fourteen mils. in thickness, because it does not pay to use thinner iron. The reduction of eddy-current loss secured by taking yet thinner core plates would be but a small advantage, considering the extra expense of rolling, cutting and assembling the laminæ. Moreover, when the assembled core plates are subjected to planing or filing, their roughened edges may be brought into contact with each other at many points, whereby the effect of lamination becomes partly lost and the eddy-current losses may be unduly magnified. As a rule the losses of power in hysteresis or molecular magnetic friction exceed those due to eddy-current losses in the cores of dynamos and transformers, with the thicknesses of sheet iron in ordinary use. It is generally found that the eddy-current loss lies between 30 per cent and 100 per cent of the hysteretic loss and is often about 75 per cent. The hysteretic loss is, therefore, the more important and the more objectionable defect in iron from the dynamo-makers' standpoint. If, however, the eddy-current loss in iron could be greatly reduced, it would permit of the use of thicker core plates for the same allowance of wasted power, or it would permit of a reduced waste of power with the same thickness of core plate. Whatever diminishes the waste increases the output of a dynamo, not only on account of the saving of power; but also, and in larger degree, by reducing the temperature elevation of the armature core.

What is wanted, therefore, is an ideal kind of iron having structural and magnetic properties equal to those of good dynamo iron, combined with a very high electric resistivity and a low hysteretic coefficient. If such an iron could be produced without large expense and could be poured like cast iron, it might be possible to cast transformer cores or dynamo armature cores, thereby greatly reducing the cost of construction of such machines. The *Elektrotechnische Zeitschrift,* has recently published an article by A. Kühns upon some tests conducted on sheets of iron stated to possess a higher resistivity than ordinary steel, together with a reduced hysteretic coefficient. This new iron alloy is claimed to have a resistivity nearly four times that of ordinary dynamo iron, and a hysteretic coefficient only half that of ordinary iron. Its permeability and other magnetic properties are not, however, set forth. A reactance coil was constructed using a square frame core of straight strip iron and the core losses were measured when the reactance coil was excited by alternating currents of various successive frequencies. The results of the tests indicate that the eddy-current losses were reduced to nearly one-fourth by the use of the new iron alloy. It is important that the complete magnetic behavior of such iron should be determined and made known, for if its structural and magnetic properties are nearly equal to those of ordinary iron, the reduced eddy-current loss would be a point in its favor for the purposes of dynamo construction. Up to the present time, attempts made to increase the electric resistivity of iron have only succeeded in doing so at the expense of magnetic permeability, so that the net result with the alloy was a loss and not a gain. It does not follow, however, that this result must always attend the addition of other materials to iron, and it is always reasonable to hope for the discovery of some new brand of iron with good structural and magnetic properties, but with reduced eddy-current and hysteretic losses.

Empire State Gas & Electric Association.

The second annual meeting of the Empire State Gas & Electric Association was held at the Hotel Astor, New York City, on October 12, with an excellent attendance and an admirable programme, which elicited discussion that prolonged the sessions until quite a late hour in the afternoon. Not only was there a large gathering of well known representatives of lighting interests in the state, but the proceedings were also participated in by Mr. H. T. Hartman, of Philadelphia, and Mr. W. H. Gardiner, Jr., of Boston, whose contributions as to technical and economic features of the industry were very much appreciated.

Mr. W. W. Cole, the president, opened the morning's session with a pithy and pertinent address, dealing more particularly with the public, as distinguished from the technical, aspects of the situation, and this was followed by reports from the executive committee, the treasurer and special committees. It was shown that there are now no fewer than 48 companies in membership—a notable gain over the preceding year—and that further acquisitions are confidently expected during the present year. The first paper presented was that of Mr. R. A. Davidson on the "Cost of Municipal Arc Lighting," embodying a valuable array of statistics, and this was followed by a paper from Mr. J. Robert Crouse, Jr., on "Co-operative Electrical Development," which secured the appointment of a committee to assist in the plan of co-operation that has already been endorsed by other associations.

After lunch, which was served in the college room of the hotel, Mr. Alfred S. Cooke offered an extremely interesting paper on the "Value of a Franchise." This elicited a very brisk and pithy discussion in which a large number of those present joined. Mr. Cooke pointed out how difficult it had been found in this state under the tax law to detect the basis of taxing a franchise, or what a franchise was worth, and Mr. Sheehan instanced a number of cases in which he had made fruitless efforts to get down to the real basis used by the authorities, if they had any. Mr. Wilkie also cited the various opinions that had been given by Judge Lacombe and others and confessed that the companies were still at sea as to franchises which were very valuable for taxation, but apparently had no value at all as the basis of the emission of securities. Mr. T. C. Martin pointed out that the practice differed in various states as to methods of securing from corporations some return for the privileges that were conceded to them, and mentioned the fact that in New Jersey a commission had recently been appointed to recommend schemes of division of profits or dividends with the communities served by the corporations. This was one way of attacking the problem. He then referred to the conditions in Massachusetts and called attention to the sliding scale scheme recently put in force there. Mr. Gardiner thereupon gave the convention a very useful account of the course of legislation and of practical work in Massachusetts and explained briefly the operation of the sliding scale by which companies are allowed to increase their dividends as they reduce their prices to the public.

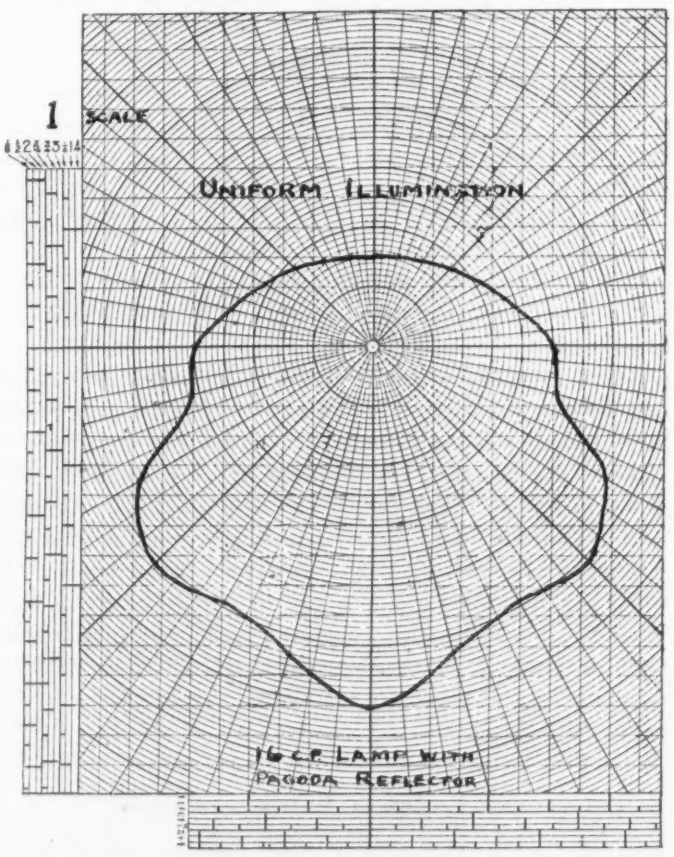
The next topic was taken up by Mr. John F. Tremaine in a paper entitled "What Can Be Accomplished by a Publicity Bureau?" and it was evidently felt by the members that they should court and could court much more publicity than they had enjoyed, as a corrective to the unfair and unjust views and statements that now found such ready circulation in the press. The closing paper of the day was a masterly review of the situation in "Municipal Ownership," by Mr. Arthur Williams, who presented a variety of facts and data showing the inherent weakness of many of the positions taken by the advocates of municipal ownership and who expressed the discouraging opinion that while the subject was by no means a dead issue, they had at least reached the point where, owing to the agitation of the question, people had begun to realize that there were two sides to the question, and that the arguments presented against corporation management and ownership were generally inaccurate and almost always misleading. This paper was heard with the utmost interest and attention. Among the topics presented for general discussion were these: "Condemning Rights of Way for Pole Line"; "Standard Pressures and Standard Candle Power," and "Underwriters' Inspection." The late hour did not permit of the public treatment of these, but they received attention informally during the day from the members and will probably be made subject of papers at the next convention.

The following officers were unanimously elected: Mr. E. H. Palmer, of Auburn, president; Mr. Carlton Macy, of Far Rockaway, vice-president; Mr. R. A. Davidson, of New York, secretary; Mr. T. R. Beal, of Poughkeepsie, treasurer; Messrs. Glidden, Searle and Diall, executive committee.

Meeting of New York Section of Illuminating Engineering Society.

The October meeting of the Illuminating Engineering Society was held at the Edison Auditorium on Friday evening, October 12. In accordance with a resolution adopted last June, it was announced that at this meeting the New York membership would be organized as the New York section of the society. A nominating committee was appointed to submit the names of officers for the section, and upon its report the following officers were elected: Chairman, Mr. A. E. Forestall; vice-chairmen, Mr. Frank A. Pattison and Dr. F. Schniewind; secretary, Mr. Preston S. Millar. These gentlemen will hold office until January, when the regular annual election of the society will be held. The secretary reported that the total number of members elected to date is 750, and that during the summer 30 to 40 members were enrolled monthly; it is expected that the membership will exceed 1,000 by the end of the year.

In the absence of the author, Dr. Clayton H. Sharp presented the paper of Mr. Ernest C. White entitled "Application of Photometric Data to Indoor Illumination." This paper was principally devoted to the explanation of a new form of illumination curve. The usual polar photometric curve was criticised as misleading in its indications, and that presented is a polar diagram representing the distances in all directions at which equal illumination is produced by the source from which the curve is plotted. As



CURVE OF UNIFORM ILLUMINATION AND CANDLE POWER DISTRIBUTION.

will be seen in the accompanying illustration, marginal scales are provided which read in feet for various intensities of illumination. The scales are laid off so that the radial difference between every tenth circle is equal to one foot for unit illumination—that is,

one foot-candle. For more powerful sources it is necessary to plot the curves to ½, ⅕ or 1/10 of this scale, in which case one division in the scale represents 2, 5 or 10 ft. instead of 1 ft. The illustration represents uniform illumination and candle-power distribution, respectively, for a 16-cp incandescent lamp fitted with Pagoda reflector.

The advantages of this form of curve are enumerated as follows: The shape of the curve represents the effect produced and not merely the cause, as in the case of the ordinary polar distribution curve. The area of the curve is not so largely affected by the character of distribution as in the polar distributon curve. The curve affords instant reference to the best locations for lights; that is, proportion of distance from ceiling and from floors, the best angles for bracket lights, etc.; and where placed within glazed fixtures, the curve is of accurate assistance in determining the shape of the art glass to be lighted up.

Mr. J. E. Woodwell, inspector of electrc light plants, United States Treasury Department presented a lengthy paper entitled "Data on Indoor Illumination." As printed the paper contains 32 illustrations and during its delivery numerous views were projected on a large screen.

Mr. Woodwell also criticised the usual polar diagram, pointing out its limitations, and referred to the present demand for a simple and practical illuminometer which shall be portable, accurate and low-priced. The Rousseau diagram was discussed and a method given for determining illumination data. The various factors in illumination were discussed generally and then specifically with reference to a large number of examples taken from Government work, such as the illumination of post office working rooms, court rooms, the Congressional Library, etc.

Mr. Woodwell stated that in the postal service, for reading addresses of mail in an endless variety of forms of pen, pencil and print with backgrounds of various color, a local illumination of from 2 to 4 foot-candles has been found by extended experience to be required; 2 foot-candles is generally sufficient for desk illumination, though for work involving much detail 3 and even 4 foot-candles has not been found excessive. For corridors, public spaces, assembly rooms, the figures range from .5 to 1.5 foot-candles, while in stores where dark goods are displayed or a brilliant effect is desired, 5 to 10 foot-candles is not uncommon. The latter amount is also required for tracing, drafting, engraving and other similar work. These intensities relate to the working plane, and in addition, consideration must be given to the walls and ceiling and whatever objects in the space are to be illuminated, and the figures determined upon for this purpose will depend principally upon the color and reflection values of such surfaces.

The following table was given of the intrinsic brilliancy of a number of common light sources, in candle-power per square inch on the assumption of a uniform light intensity over the surfaces considered.

Moore tube.....	¼ to 1½	
Gas arc lamp.....	1 to 2	—alabaster globe.
Candle	3 to 4	
Cooper Hewitt lamp.	3 to 6	—approximate.
Incandescent, frosted.	2 to 8	—depending upon efficiency and style of bulb.
Kerosene oil lamp...	3 to 8	
Mantle burner.....	20 to 25	—unshaded.
Acetylene flame	75 to 120	
Enclosed arc.....	100 to 200	—depending upon globe used.
Incandescent lamp...	100 to 300	—bare.
Nernst lamp.....	800 to 1000	—bare.

As a brilliancy in excess of five or six candle-power per square inch produces retinal fatigue and irritation, it will be seen that the most common illuminants require shades or enclosing globes if placed within the field of vision. Even where illuminants of great brilliancy are located out of the field of vision, care must be taken to avoid regular reflection from objects to the eye, as light of comparatively low intensity entering the eye at an unusual angle is quite as detrimental as excessive brilliancy in the direct line of vision.

The economy of the Cooper Hewitt mercury vapor lamp was pointed out in connection with the lighting of a post office working room. As originally planned, for incandescent electric lighting, the equipment would have required 10.35 kw, while with the mercury vapor lamp actually installed the demand was only 3.15 kw. The advantage of this source of light is stated to be its low consumption, .60 to .75 watts per candle, and low intrinsic brilliancy. A room of similar dimensions in the Bureau of Engraving in Washington, lighted with incandescent lamps, requires a total input of 8.58 kw.

It was stated that the inverted gas mantle is apparently particularly efficient and satisfactory as applied in postal work room illumination by reason of the large percentage of light below the horizontal—67 per cent as compared with 45 per cent for the upright mantle burner. The following data were given of the lighting of three United States court rooms and the newspaper reading-room of the Library of Congress (IV), in each case electric incandescents being used. The lights are taken at their ratio of mean horizontal candle-power:

Case.	Floor area sq. ft.	Ceiling height, ft.	Cubic contents, cu. ft.	Total c.p.	Kw. input.	Cp. per sq. ft.	Sq. ft. per cp.	Cu. ft. per cp.
I as installed	3320	25	83000	3192	10.78	.96	1.04	26.0
I as used	....	..	.....	2336	7.70	.70	1.42	35.5
II	2340	30	70200	3104	10.03	1.33	.75	22.6
III	2094	18⅓	38381	1740	6.09	.83	1.20	22.1
IV	7525	19⅓	145483	3808	11.80	.51	1.98	38.2

The two papers of the evening were discussed together. Those joining in the discussion were Messrs. E. L. Elliott, A. H. Elliott, T. J. Litle, W. H. Gardiner, Jr., R. M. Searle, H. H. Seabrook, Clayton H. Sharp, William J. Thompson and President Marks.

Mr. E. L. Elliott commended the form of curve proposed by Mr. White as a ready means of determining the very data which the illuminating engineer most frequently wants—that is, the illumination in foot-candles at given distances from a certain light source. He suggested the use of a separate scale in place of those printed at the side and bottom of the diagram, and thought it would be well to omit some of the circles. He believed the illumination of the reading-room of the Library of Congress to be positively the worst example of lighting for the purpose that he has ever seen. It is impossible to get in any position in the room in which one does not have a line of light staring him straight in the eyes. He considered it would have been better to place the lights directly over the reading desks instead of midway between. Dr. A. H. Elliott referred to the great importance of the distribution of light as compared with the intensity of its source. Referring to reflection of light, he thought it might be best to let the rays first strike a white surface, such as one of plaster of paris, which reflects 80 per cent of light, and be distributed therefrom, rather than have an intense point of light which has to be toned down by globes at a loss anywhere from 15 to 50 per cent.

Mr. W. H. Gardiner, Jr., referred to many complaints, particularly from gas consumers, that the gas used is not as good as formerly, and that they now have to light two or three burners where formerly one was sufficient. Mr. Gardiner believes these complaints to be due to the fact that formerly people were satisfied with a much lower degree of illumination than what they consider desirable at the present day, having had their perceptions altered through becoming accustomed to the very bright lighting in public places. Dr. H. H. Seabrook said that in his opinion the reason why eyes give out with the same illumination to which they have been accustomed formerly is because there is much more work done at night, the eyes become fatigued and the tendency is to increase the intensity of the illumination. However, when the intensity of illumination is increased the pupil contracts and the eye simply becomes more fatigued. He has known many people to resume the old kerosene burner with which it is impossible to increase the rays beyond a certain point, and which gives only a fraction of the illumination that the electric light does, and then find this illumination sufficient. Dr. Clayton H. Sharp in referring to the illumination of the newspaper reading-room of the Library of Congress said he did not suppose there was any question but that there is a sufficient amount of light in the room. The illumination on the newspapers, however, is not good, not because there is not light enough, nor entirely because there is a glare of light in the eyes of the reader, but because the light does not fall on the newspapers at the right

angle. We must consider the direction from which the light comes in order to get the proper illumination. It is not sufficient to illuminate a sitting-room, for example, with one common-sized lamp up near the ceiling, not because it will not produce enough illumination, but because in order to utilize that illumination we have to hold a book or paper more or less in a horizontal position, whereas it is natural to hold the paper so that it receives the light not from the ceiling, but from a point well below the ceiling. In other words, the rays illuminating the vertical plane are more useful under these circumstances than the vertical rays illuminating the horizontal plane. It is not in all cases by any means sufficient to consider alone the illumination on the horizontal plane in a room. We must take account, and very marked account, of the illumination on the vertical planes and also the normal illumination in many cases. Dr. Sharp stated that there is no difficulty in showing from records that the standard of illumination has steadily increased; that if we go back to the days when illumination was practically entirely from candles, and compare that with the illumination produced by the gas flame, the illumination in the latter instance is much higher. The gas of to-day is condemned as against the gas of twenty years ago because we have become accustomed to a higher degree of illumination, and the illumination which was formerly found sufficient is now insufficient. The gas people have found that the effect of introducing a lamp which will give 15 cp for one foot of gas has been that they have sold more gas. That is to say, the public has taken the value of its money, not in decreased bills, but in increased light, and the result has been largely increased illumination. That is likely to be the effect also from the introduction of the higher efficiency incandescent lamps, and is only another indication of the constant tuning up of the average scale of our illumination.

Mr. Thompson gave the result of some experimenting with the illumination of an office having four windows facing the south in order to escape eye trouble. He tried various screens, awnings and shades of different thicknesses, and finally accidentally came upon the idea of hanging a large sheet of tracing cloth over one of the windows and putting double sheets on the others. There appears to be practically as much light at his desk as before, but there is now perfect diffusion and he has had no further trouble with his eyes. The experiment has shown that with proper diffusion a large quantity of light is necessary, and as a consequence of this experience he now uses during evenings a 32-cp lamp with a green shade, white inside, and at the same time has other lights in the room to produce a proper general effect. President Marks expressed the opinion that our sources of illumination are entirely too bright and that even in the best designed lay-outs the intrinsic illumination is higher than the figure obtained in the measurement of an ordinary ground glass window in good daylight. The lowest figure which Mr. Woodwell gives for illumination is one-ninth candle-power per square inch. President Marks said that it would be found that in a well-illuminated room in the daytime with ground glass windows this figure will be as low as one-fiftieth or even one-hundredth of a candle-power per square inch, and that he believes is what we want to get to. Mr. Williams related an instance which he considered to show that the illumination in our homes is now too high. In a dining-room two 16-cp lamps were changed to two 8-cp lamps, and finally one of these burned out; it was then found that this one 8-cp lamp gave sufficient light. In the library of the same house there are three 16-cp lamps and another light in the hall, which shines into the reading-room; it was found in reading more satisfactory to have the hall light turned out.

Use of the Telephone at Automobile Races.

To anyone interested in the practical side, the managing of the big automobile race recently held on Long Island and the extent to which the telephone was used in "keeping tabs" on the big racing cars and in transmitting orders and information is of more than passing interest. To telephone men, also, a description of the special telephone plant installed is of particular interest as an example of efficient telephone work under rather unusual conditions. It was necessary to install and operate two distinct systems—the first, consisting of timing and checking circuits, in order that the cars entered in the race might be followed from the official stand and grandstand in their trip around the course, so that the officials and spectators might keep in touch with what was going on not only before them, but all around the circuit as well. Second, a system of private and public lines, in order that the newspaper correspondents and the general public might at any time communicate with the city or with other outside points.

To keep in touch with what was going on around the course twelve telephone lines, connecting stations located at each of the

FIG. 1.—ONE OF THE TELEPHONE STATIONS.

twelve turns with telephones located at the official stand, and five timing circuits, connecting telephones in the official stand with telephones connected at the 5, 10, 15, 20 and 25-mile points, respectively, were installed.

The telephones located at the turns and timing stations along the course were nickel desk sets, equipped with head and hand receiver, magneto and dry batteries enclosed within regular wooden cable terminal boxes attached to poles at the designated points. The telephones at the official stand end of these lines were nickel desk sets, with head and hand receiver, magneto and batteries, placed along a shelf on the second floor of the stand. When bulletins were received a force of clerks indicated the drivers' places on a great map over the stand.

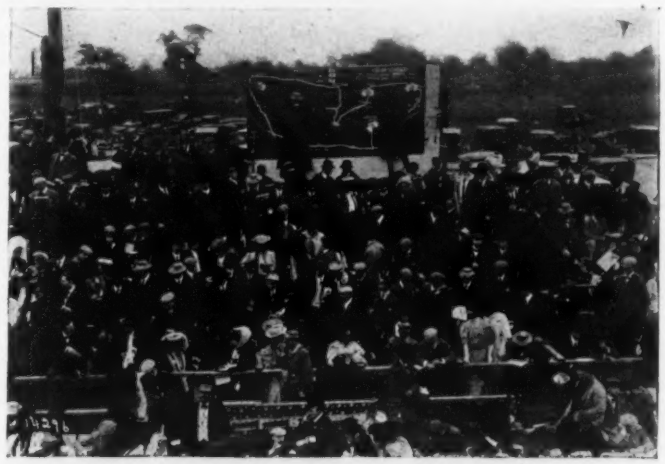


FIG. 2.—MAP ON GRANDSTAND BY WHICH SPECTATORS FOLLOWED THE RACES.

In order to make up the lines connecting the telephones in the pole boxes with the telephones in the stands, four miles of 25 lead cable were placed temporarily on poles from the official stand to a point at Albertson, where suburban toll trunks, additional cable facilities to Roslyn connecting with existing wires on poles toward Great Neck, were available, and could be used to complete the circuit.

The Associated Press and several of the newspapers installed private lines from their offices to the official stand. Several other

special circuits also were installed, including one to the private car of President Peters, of the Long Island Railroad, located at a siding just north of the Jericho Turnpike, at Mineola, and several circuits to the headquarters of the various automobile companies located near the course. A telephone line was also established between the official stand and the band stand for the purpose of directing the band master.

To accommodate the general public and such newspaper correspondents as had not contracted for private lines, a two-position switchboard was installed in a portion of the official stand with trunk line connections to the Long Island toll board, the Roslyn central office, the Garden City central office and tie lines to the switchboard at the Garden City Hotel. From this switchboard extensions were run to the public telephone room at the official stand, the grandstand and various important points nearby.

The total circuit mileage of the timing and checking system was 78 miles; the total mileage of the newspaper system, 215 miles; the pay station system, 155 miles, making a total mileage of 448 miles. Of this total mileage 292 miles of existing circuit was used, and 156 miles was placed temporarily. The entire system was efficiently operated, an ample force of uniformed operators, attendants, messengers and supervisors being provided. A special pay station department inspector was also on hand to look after any irregularities that might arise.

In spite of this ample equipment there were occasional periods when the demand for service taxed the installation to its fullest capacity. There was, however, no delay. The service was efficient and satisfactory in all respects. This telephone service was installed and maintained by the New York & New Jersey Telephone Company.

Annual Report of the Boston Edison System.

The figures of the twenty-first annual report of the Edison Electric Illuminating Company, of Boston, are very interesting in their exhibit of growth and increase of business. The statistics come down to June 30, 1906, and are as follows:

	1906.	1905.	1904.	1903.
Gross	$3,780,911	$3,346,027	$3,125,516	$2,667,808
Expenses	2,410,485	2,143,106	2,009,691	1,683,085
Net	1,370,426	1,202,921	1,115,825	984,723
Mis. profit ..	49,256	33,286	37,396	32,501
Total net ..	1,419,682	1,236,207	1,153,221	1,017,224
Int. & divs...	1,227,776	1,164,790	1,075,813	955,970
Surplus	191,906	71,417	77,408	61,254

Included in expenses this year are taxes amounting to $445,508, against $366,450 last year.

Lamps and motors connected as of date June 30, as follows:

	1906.	1905.	1904.	1903.
Incan. lamps.	788,560	708,384	627,441	493,402
Arc lamps ...	10,534	10,102	9,358	8,196
Motors, h.p...	30,432	26,416	24,150	20,801

Of the increase shown for the fiscal year just closed, 9,062 incandescent lamps and 4½ hp of motors were added in the purchase of the Medfield Electric Light & Power Co., and the Medway Electric Light & Power Co. The remainder, viz.: 71,114 incandescent lamps, 432 arc lamps, and 4,011½ hp of motors is the increase in new business for the year.

Leaving out of consideration the new business acquired in the purchase of the property of other companies, the regular increase during the current year is greater than during any previous year in the company's history. There have been no changes in the prices at which the electricity was sold during the year.

Since the close of the current year a new price list has been put into effect which favorably affects more than 14,000 of the company's customers. Although this will materially cut down the income from existing customers, it is confidently expected that it will be more than made up by the resultant new business.

During the year the properties of the Medfield Electric Light & Power Co. and the Medway Electric Light & Power Co. have been purchased. The steam stations in Medfield and in Woburn are still being operated. Plans are being made for a transmission line to reach these two points, and it is hoped that these stations can be shut down during the coming summer. The steam apparatus in the Natick and Somerville stations has been disposed of, so that with the exception of the two stations named above, all of the steam apparatus of the company is now concentrated in the Atlantic Avenue station, and in the L Street station, South Boston.

There has been no change in the capital stock of the company during the past year. Although the natural growth of the company has been great, such money as has been needed for construction purposes has been raised by temporary notes. It is expected that during the coming year the stockholders will be called together again for the purpose of authorizing a petition to the board of gas and electric light commissioners for additional capital.

Convention of the Michigan Electric Association.

The Michigan Electric Association, which is the organization of electric light and power men of Michigan, held its 1906 convention at Grand Rapids, October 10, 11 and 12, at the Livingston Hotel. The first session of the convention was called to order at 11 a.m. by President William Chandler, of Sault Ste. Marie. He introduced Mr. Daniel McCool, president of the Grand Rapids Edison Company, who extended the hospitality of Grand Rapids to the convention. President Chandler then read his address which he introduced by saying that he would not attempt to cover any technical points, as his interest in the plant at Sault Ste. Marie was in a financial and business way rather than technical. He considered that the association offered an excellent place for the exchange of ideas. The programme committee had purposely provided but few papers so that there might be ample time for discussion. He referred to the importance of the work done by the insurance committee of the Illinois State Electric Association in securing better insurance rates on central stations and favored similar efforts on the part of the Michigan Association to get a reduction in insurance rates on electric light and power stations in Michigan. By proper action a large saving in insurance could be effected with a small outlay.

Good service is the first requisite in the carrying on of an electric light and power business. He spoke very strongly as to the duty of electric light and power companies to keep their pole lines and other property on the street in good condition, and thus show their appreciation of the franchises given them. Pole lines are at best not ornamental and they should be made to interfere with the good appearances of streets as little as possible. In the matter of tree trimming he urged that the necessary trimming be done with the consent and co-operation of the property owner. Shade trees on streets were usually the results of years of effort to cultivate them. Rather than trim them to destruction, the company could afford to go to considerable expense. He urged that some one on the staff of every electric light company be posted in the art of illumination. Electric light if properly used and not wasted was one of the best illuminants, but could be made one of the worst by improper use.

The executive committee announced the appointment of a nominating committee as follows: Mr. R. W. Hemphill, Jr., of Ann Arbor; Mr. A. F. Walker, of Grand Rapids, and Mr. F. A. Beard, of Flint.

Mr. E. F. Phillips, of Detroit, made a motion, which was carried, to appoint an insurance committee to follow up the work which had been done by the secretary in canvassing the insurance situation during the past year.

COMMERCIAL CO-OPERATION.

Mr. J. Robert Crouse, Jr., of Cleveland, presented the question of profitable commercial co-operation and the work of the Co-operative Electrical Development Association in somewhat the same manner as at the National Electric Light convention and at subsequent state association meetings. He showed the immense money value both to manufacturers and central stations of a few per cent increase above the regular increase in central station growth of the past few years. He reviewed the plans presented at the National convention and at the close of his remarks, in answer to questions by various members, threw considerable light on

some matters which have not been well understood by central station men, as to the work which the Co-operative Electrical Development Association has been doing up to date.

Mr. Hemphill, of Ann Arbor asked how a small company could go to work immediately to get the benefits of the scheme at the present time. Mr. Crouse replied that this could be done by making use of the facilities offered by the advertising companies which were now in the central station field. A year ago there were only two central station companies taking advertising service of advertising agencies. The entrance to the central station field of the three agencies now actively engaged in this work was only made possible by the agitation of the subject and the financial assistance offered by the Co-operative Association. In answer to a question as to what percentage of the gross receipts a central station should set aside for the promotion of new business, Mr. Crouse did not venture to offer a personal opinion, but quoted a statement made in convention by Mr. J. F. Gilchrist, of the Chicago Edison Company, to the effect that 3 per cent of the gross receipts was considered the proper maximum by that company.

Mr. Crouse was asked as to whether the Co-operative Association had made it possible for central station companies to secure advertising matter from the advertising companies at a lower rate than it could otherwise have been secured. Mr. Crouse replied that the association had financially aided in the preparation of certain advertising matter. Mr. Mauger cited a specific case, that of the Schenectady Illuminating Company, which was able to obtain its advertising matter at a much lower rate than if the advertising companies had not been supplying similar matter to other central stations over the country. In answer to further questions as to the exact relations of the Co-operative Association to the advertising agencies, Mr. Crouse explained that at the beginning of the movement eight advertising agencies were asked to submit bids and plans for an advertising campaign to cost $10,000 to start the movement. Representatives of these agencies met at Cleveland and the contract was awarded to the Curtis Advertising Company, of Detroit, which presented the most acceptable plan. There are now two other advertising companies in the central station field with which the association is in close touch and with which the relations are most friendly, as these companies realize that it was through the association's efforts that the matter of central station advertising was being stirred up so that central station business was possible for them. These advertising agencies are the Bates Advertising Company, of New York, and the C. W. Lee Company, of Newark, N. J., To all of these the Co-operative Electrical Development Association was in some degree contributing and would show no favoritism. Later on it is expected to start a National Press Bureau for the giving out of electrical information of general interest to the daily press of the country and also to take up the question of the general promotion of central station service by magazine advertising. Mr. Crouse requested that a committee of two be appointed to represent the Michigan Electric Association in the Co-operative Electrical Development Association and it was voted to appoint such a committee.

"New Business and Advertising" was the subject of a paper by Mr. D. B. South, of Sault Ste. Marie, which provoked an interesting discussion. An abstract of this paper and discussion will appear in a later issue. After this discussion the convention received an invitation from Mr. Waldo Francisco, chief engineer of the Grand Rapids Edison Company, to visit its power and sub-station on Fulton Street. The invitation was taken advantage of by many immediately following adjournment. The company receives part of its power over high-tension transmission lines from water power plants and part is generated by a steam plant.

Thursday morning Mr. H. J. Mauger, of the General Electric Company, Schenectady, New York, gave a talk on "The Commercial Status of Electric Heating and Cooking Devices." The points covered by Mr. Mauger were practically the same as those presented at the Ohio Electric Light Association and given on page 487 of the September 8 issue of this journal. He described in detail the construction of General Electric heating units and then outlined a general line of policy to be followed by central station companies. The electric flatiron should be the first device introduced, as it is the best revenue producer and the greatest household convenience. After this there are a half-dozen little heating and cooking appliances which can go on lighting circuits which should be pushed. Later on heavier cooking appliances which call for special circuits can be taken up, but central station men themselves should first put in heating circuits in their own houses and try these things. He suggested that heating pads could well be applied through druggists, not by selling them to the druggist who will want a very large profit, but by letting him sell on commission, so that he need invest no money. He urged central station men to get new houses wired with heating circuits wherever possible, so that they will not be handicapped by the expense of running such circuits when the time comes that these devices are in demand. An abstract of the discussion following this paper will be given in a later issue. President William Chandler invited the association to hold its meeting at Sault Ste. Marie next year, if the members thought that the inaccessibility of the place would not detract too much from the attendance. Mr. A. J. Bemis, manager of the Grand Rapids & Muskegon Power Company, invited the convention to come to Grand Rapids again next year when the company would have some very interesting work to show in the way of 66,000-volt transmission lines and large water power plants. The location of next year's convention will be decided by the executive committee. An informal vote for an expression of opinion was in favor of holding it at Sault Ste. Marie.

Mr. R. W. Hemphill, of Ann Arbor, gave a talk on "The Importance of Making a Good Impression Upon the Public," an abstract of which will appear in a later issue.

Thursday afternoon Mr. Chas. A. Parker, of the Curtis Advertising Company, Detroit, read a paper on "Direct by Mail Advertising of Central Station Current," an abstract of which will be given in a following issue.

Mr. F. A. Beard, of Flint, gave a talk on the question, "Does it Pay to Reconstruct and Modernize Plants in Small Towns?" He described the modernizing processes which had been going on at Flint for the past seven years, but as to whether it paid, he said he would be in a better position to tell a year from now, after the change was completed. The entire plant needed reconstruction seven years ago. There were 15 or 20 different types of transformers and these were taken out and one or two makes of 60-cycle transformers substituted. The meters were all changed with a view to changing from high frequency to 60 cycles. They are now in the midst of changing to two-phase 60-cycle generators with two-phase power lines and single-phase lighting feeders. Arc lighting will be done by a motor-generator driving the old direct-current arc dynamos, but the arc system might be changed to some of the new systems which are just coming up.

Mr. Francis W. Willcox, of the General Electric Company, presented a paper on "New Developments in Incandescent Lamps," which in substance was the same as that presented to the Ohio Association and given in abstract in these columns on page 486 of the issue of September 8, 1906. One interesting fact not mentioned in the previous paper, however, was that the manufacture of the old style 100-cp incandescent lamp has been entirely discontinued in favor of the new Gem filament lamps, as the old 100-cp common carbon filament lamps were unsatisfactory. An abstract of the discussion following this paper will be given in a later issue.

Friday morning, the secretary read a paper written by S. A. Padfield, of St. Clair, on "The Benefits of the Association to the Smaller Companies." The paper was full of wit and humor as well as very much to the point on the necessity of the smaller companies taking part in the Association if they were to make the best of their properties. It was voted to have this paper printed and distributed to all of the small electric light companies of the State. Secretary Marshall said some words commendatory of the way Mr. Padfield conducted the business of a small municipal plant at St. Clair. The Michigan Association, unlike some state electric light organizations, welcomes to its membership everyone engaged in the electric light and power business whether he is an employee of a city or of a private corporation.

The President then called upon Mr. A. E. Palmer, of Kal-

kaska to tell something about the remarkable work he had done in developing electric light and power business in a town of 1,700 population. A description of the work done by Mr. Palmer's company at Kalkaska will appear in a later issue. It emphasized a point brought out by President Chandler, that frequently the managers of the smaller companies could set the standard which is very hard for the larger companies to attain, and that it is not always a case of the smaller companies learning from the larger, but sometimes the reverse. For example, the Kalkaska company has 115 electric irons connected and a day load equal to 80 per cent of its winter peak.

Friday afternoon the convention listened to an address by Prof. Gardner S. Williams, of the University of Michigan, on "Water Power Development in the State of Michigan." He pointed out that the improvement in water wheels the past fifty years has not been as marked as in other machinery. Fifty years ago turbine water wheels were built with 85 per cent efficiency. At the time the first wheels were built for the big Niagara plant the fact that European designers were called in for the water wheels was taken as a reflection on American water wheel manufacturers. Where American manufacturers, however, had experience in water wheel building, for given conditions, they turned out a product as good or better than European makers. He cited the recent bids made on a large water wheel installation where an American branch of an European water wheel company bid 40 per cent higher than American makers and guaranteed a lower efficiency. Many American wheels have been built to give 80 per cent efficiency. Prof. Williams was sure of this from his own tests. Generally speaking, wheels built for higher heads are more efficient than those for very low heads.

The storage of water will play an important part in the future water power development in Michigan. For example, the Huron River in one day during a flood passed a greater amount of water than during the entire two months of July and August last summer. An area of 3,600 square miles in Michigan is over 700 feet above the lake level. Much of this is poor country for farming, and is of a sandy nature. Dams built to impound water for storage purposes would insure an immense storage capacity not only above ground but in these sands. Water held in the sand is subject to but small evaporation, so that these sandy storage areas should be very valuable. He suggested that the State develop a system of storage reservoirs and levy a tax on those utilizing the water power along the river. If this was done the present power plants could develop at minimum flow three or four times the power they are obtaining now. It is doubtful if such a system would be developed by private interests for a long time, although private interests would probably develop such storage reservoirs in course of time if the State did not do it. It is important that accurate data for a number of years be kept on the flow of water in the various streams. This the United States Geological Survey has been doing, but recently the appropriation had been cut down, and it was doubtful whether all the gauging stations in Michigan could be maintained. The absence of the data obtained at these stations would seriously hamper water power developments in the future, and it was to be hoped that Congress would reconsider its action so that these stations could be kept up.

Following Prof. Williams' address, the Association passed a resolution of protest against reduction in the appropriation for gauging Michigan rivers.

Officers for the next year were elected as follows: President, William Chandler, Sault Ste. Marie, Mich.; vice-president, A. F. Walker, Grand Rapids; secretary and treasurer, A. C. Marshall, Port Huron; executive committee, members to serve two years, Alex. Dow, Detroit; F. A. Beard, Flint. To serve one year, T. F. Bechtel, Grand Rapids; finance committee, E. F. Phillips, Detroit; O. S. Wood, Ionia, and A. E. Palmer, Kalkaska.

A number of small parlor exhibits were made. W. N. Matthews & Bro., of St. Louis, represented by V. L. Crawford, had an exhibit of Stombaugh guy anchors, Kearney cable clamps, and the new "hold-fast" lamp guard which supports the lamp bulb with a spring so that it is almost impossible to break it when in the guard.

The Fostoria Incandescent Lamp Company had an exhibit in charge of W. J. Trott, of Grand Rapids, which showed the various stages in the manufacture of an incandescent lamp beginning with the cellulose and so on through the various processes. The new high efficiency Gem filament lamp was shown and also some round bulb tipless lamps with opalescent glass, the adopted standard of a large steam railroad company for car lighting.

The Electric Appliance Company of Chicago had a large parlor which was the headquarters for that "organization of foolishness," known as the "Hustling Hundred." Initiations were held hourly. Thomas G. Grier, of the American Circular Loom Company, acted as master of ceremonies. The principal exhibit was the new Sangamo watt-hour meter, which was explained by F. J. Alderson. W. P. Upham and a corps of other salesmen represented the company.

The W. J. Barr Electric Manufacturing Company exhibited one of its electric irons, a type which is used extensively in the flatiron campaigns of Michigan companies. The removable heating element in this iron consists of asbestos covered resistance wire wound between strips of copper, the copper strips serving to conduct the heat down to the bottom of the iron. The cord holder on this iron is another good feature, preventing the breaking of cords and cord troubles in general. George R. Craven, secretary and treasurer of the company, was present.

The Bryan-Marsh Company, represented by Mr. Godfrey, made an exhibit of tantalum and Gem filament high efficiency lamps.

The Brilliant Electric Company, of Cleveland, had high efficiency Gem filament units in prominence in several places in the hotel as well as in its parlor exhibit.

Westinghouse representatives occupied a parlor where indicating and recording meters were on exhibition and the advent of a tungsten lamp to consume 1.2 watts per candle was promised.

The Ft. Wayne Electric Works had as one of the most novel features of its exhibit its prepayment meter and a separate prepayment device by which any Ft. Wayne meter with slight changes can be used in connection with the prepayment plan, the prepayment device being located in a more convenient place than the meter. The Wood series arc constant-current transformer was also shown in operation.

The General Electric Company exhibited its coffee percolator, chafing dish and flat iron. A new handle has been designed for its latest type of iron, this handle having better heat insulation than the one previously put out.

The Shelby Electric Company, Shelby, Ohio, represented by Mr. William Love, kept open parlor.

American Street Railway Association.

The annual street and interurban railway convention was opened at Columbus, Ohio, on Monday by the meeting of the American Street and Interurban Railway Engineering Association, formerly known as the American Railway Mechanical and Electrical Association, and one of the several bodies affiliated with American Street and Interurban Railway Association, the parent organization. The first session was called to order by President H. H. Adams, who introduced Mr. E. C. Spring, president of the Central Electric Railway Association, who welcomed the convention to Columbus. Referring to the association of which he is president, Mr. Spring said that it comprises all the Middle Western States and represents more particularly the interurban field. The interurban field, he said, is quite distinct from that of the street and suburban railway, and he directed attention to the great expansion of interurban traffic in Ohio and Indiana. President Adams then introduced Mr. James H. McGraw, president of the Manufacturers' Association. Committees of the association, he said, had been at work since last March and the result is shown in the six buildings well laid out, well equipped and filled with exhibits. Moreover, all work had been completed and everything was in readiness on Saturday evening. The exhibit was an ideal one and such as had never previously been gathered at a convention. Referring to the present organization of the association, he believed that the parent organization and affiliated associations will become by far the greatest industrial and technical organization of the kind

in the country, and he assured the members that the Manufacturers' Association will co-operate to its fullest extent in making the annual gatherings successful both in a social way and through its exhibits. After some remarks by Mr. John I. Beggs, who spoke in high terms of the present status of the association, President Adams delivered his address.

President Adams referred to the fact that the American Street and Interurban Railway Engineering Association is now connected in a definite manner with the main body, the American Street and Interurban Railway Association, and linked closely with allied bodies, namely, the American Street and Interurban Railway Accountants' Association and the American Street and Interurban Railway Claim Agents' Association. He directed attention to the fire-proofing of buildings and said that if some combined steps could be taken in this connection it would be of great benefit. While it was a matter that interested particularly the insurance committee, the details of construction come under the cognizance of the Engineering Association. Referring to standardization, he said that at the present time the association has under consideration brake shoes, wheel treads, flanges, journals, journal boxes and rail sections. It was hoped that in the future certain parts of the electrical equipment will be standardized, especially such parts as commutators, brush holders, brushes, gears, pinions and axle bearings. At the afternoon session President W. Caryl Ely went into the details of the latest reorganization of the association, and cited the benefits that would accrue to all through the carrying out of the plan adopted.

The presentation of the report of the Committee on Control Apparatus led to a discussion of the subject. Mr. G. J. Smith, of Kansas City, said that the Metropolitan Street Railway, of Kansas City, had for the past several months in service 30 cars on which the multiple-unit control system was used, which was found to be far superior to the platform controller, and that 120 additional cars would probably be similarly equipped. In handling very heavy currents, the platform controller is deficient and through short-circuiting is apt to cause a panic on the car. Mr. E. W. Olds, of Milwaukee, said that his company put into service last year 50 cars with the contactor in series; in throwing off the current the contacts were opened a little ahead of the controller. With this arrangement there has not yet been any blow-out on the front platform of any of the 50 cars. Should a short-circuit occur the motorman can at once throw his handle to position which stops the fireworks. Seventy-five more cars are being equipped with this type of control. President Adams stated that his company has also had excellent results from the use of the contactor combination. Mr. F. E. Case said that the multiple-unit control system to which some of the previous remarks had referred is well adapted to cars of 200 hp or thereabouts and above, at which size the ordinary cylinder control becomes somewhat bulky. Multiple-unit equipments have been furnished by his company for a large number of cars not intended for multiple-unit operation, on account of the control apparatus being under the car and the consequent avoidance of heavy currents on the platform. Mr. Paul Windsor, of Boston, considered that the platform controller is not a safe thing to use even on an equipment of moderate size, and a year or more ago the Boston Elevated Railway Company fitted up 40 cars equipped with two 65-hp motors each with multiple control. Mr. William Cooper thought that 200 hp was rather too high as a limit for the use of multiple control, and he thought there was no reason why multiple-unit control should not be successfully operated on much smaller equipments. The main consideration is to get all of the high voltage wiring and the main circuit under the car, keeping them off the platform.

On Tuesday the subject of standardization led to a lengthy discussion. Mr. Olds, of Milwaukee, said that his company had standardized many parts and other speakers thought that many motor parts could be standardized. No standard was recommended and the matter was referred back to the Standardization Committee. Mr. Paul Windsor then read a paper on "Gas Engines," which is abstracted elsewhere. The paper was discussed by Messrs. Bushnell, Hewitt and Roberts. The paper by Mr. H. G. Stott, on "Underground Cables," an abstract of which appears elsewhere, was then presented, and discussed by Messrs. Reed, Latey and Windsor. In the afternoon the paper on steam engines by Walter Goodenough, of which an abstract appears below, was read. The final paper of the session was that of Mr. E. H. Anderson, on "Economy in Car Equipment, Weights and Schedules," which was discussed by Messrs. Storer, Ralston and Olds.

UNDERGROUND CABLES.

The paper by Mr. H. G. Stott dealt with underground cables as employed in electric railway work. It was pointed out that since cables can now be obtained for 25,000 volts underground transmission by three-phase with grounded neutral is now possible with 44,000 volts between main leads. For potentials above 22,000 volts it seems likely that some form of varnished cambric or impregnated cloth will take the place of the paper now almost universally employed for insulation. The lead sheaths of high-tension cables in every manhole should be wrapped with asbestos in order to afford protection from an arc caused by any one of them burning out. The neutral point of the generators or transformers should be grounded through a resistance of such dimensions as to limit the current flowing through it when a ground occurs on a high-tension feeder, to the amount necessary to trip the overload relay, so that the oil switches on the grounded feeder may go out quietly without any disturbance whatever to the rest of the system. The author stated that, in his opinion, at least 75 per cent of cable trouble is caused by defects in the lead sheath and not by defects in the insulation. The life of the insulation is determined wholly by the degree of perfection obtained in excluding moisture from it.

ECONOMY OF TURBINES AND ENGINES.

Mr. Walter Goodenough presented a paper showing the relative steam consumption of turbines and reciprocating engines at varying percentages of rating. The author assumed the price of coal at $2.00 per ton, and the evaporation per pound of coal as 7.5 lb. of water and estimated the cost of engines, generators and necessary auxiliaries at $52 per kw and the cost of turbines, generators and auxiliaries at $65 per kw for 500-kw units and $39.50 and $37.50, respectively, for 1,500-kw units. He assumed the fixed charges for the engine-driven units at 19 per cent per year, and 17 per cent per year for turbine-driven units. Basing his calculations on the further assumption that each unit is to run 24 hours per day at a certain load, the author showed that the point of maximum economy for the engine unit occurs at about 125 per cent of its rating and for the turbine unit at about 145 per cent. He concludes that although it is not possible to operate the units at continuous loads above 100 per cent of rating, there is no valid excuse for not maintaining the loads as near as possible to 100 per cent rating for each individual machine.

INTERURBAN FREIGHT AND EXPRESS.

A paper by Mr. Edward C. Spring on interurban freight and express discussed the difficulties incident to the operation of an express business due to the necessity of using wagons in the delivery and collection of express matter. However, in many instances the handling of heavy freight can be made to produce a fair return if properly conducted. Since the standard electric equipment is not able to care of heavy freight work, the author suggests the use of a steam locomotive. About one-half of the present interurban roads can operate light locomotives by changing a few grades, curves, etc.

HEAVY ELECTRIC TRACTION.

A paper having for its title "Elevated Railways and Their Bearing on Heavy Electric Traction" was presented by Mr. H. M. Brinckerhoff. The electric railways treated include the South Side and Oak Park and Chicago railways, the Manhattan and Interborough systems in New York, the elevated division of the Brooklyn Rapid Transit system and the West Side Elevated Railway in Chicago. With the exception of the New York Interborough and the Chicago West Side Elevated, each of the above-named roads was equipped initially for operation by steam locomotives. The operating cost per car mile was given in each case. It was shown where electric service was substituted for steam there was a decrease in cost per mile, an increase in schedule speeds and a very large increase in traffic. In addition to its economy electric operation shows for three following advantages over steam operation: (1) An increased capacity

per car unit due to greater availability for service and higher schedule speed; (2) an increased capacity for the system in general, due to the shorter intervals possible at terminals and junction points, abolishing of relays and general facility for handling at stops and in yards; (3) an increased earning capacity due to 1 and 2, and to more attractive service by reason of greater frequency of trains possible with economy, a cleaner and quieter service, etc., giving returns in larger proportion than the direct ratio of apparent increased facilities. The physical drawbacks involved in steam operation of the large railroad terminals have been primarily instrumental in clinching the arguments for "heavy electric traction" for terminal operation. That this system when once introduced in even this limited form will extend to main line work seems certain. Radical changes in steam railway methods in yarding and dispatching trains, in reduction in size and increase in number of train units, it is believed will follow as an inevitable result of the application of electricity to steam railway operation.

RAILWAYS IN SPARSELY SETTLED COMMUNITIES.

A paper by Mr. E. P. Roberts contained an extensive discussion of electric railways in sparsely settled communities. Much information was given concerning the methods employed in estimating the probable annual income from the various communities, according to the density of population along the route, the required electrical equipment and the most economical schedule speeds, the location of the power house and the probable operating expenses.

Gas Engine Power Stations.

Mr. Paul Windsor, chief engineer of motive power and rolling stock of the Boston Elevated Railway Company, in a paper read before the Columbus Street Railway Convention, described two gas engine electric power plants recently installed by the Boston Elevated Railway Company, one of which has been in operation about four months and the other only recently started. In considering the question of supplying power to two sections of the railway somewhat difficult to reach from the present power stations of the company, it was decided to install gas engine plants. Both plants are small, one being of 700 kw and the other of 975 kw capacity. The equipments of these two plants are radically different. The earlier plant—that at Sommerville—has down draft suction producers, and four-cycle, single-acting engines, while the later plant—that at Medford—has up draft producers, and two-cycle, double-acting engines.

The equipment of the Medford station in detail consists of wood gas producers with blowers, tar extractors, scrubbers, etc.; Koerting two-cycle, double-acting gas engines, and Crocker-Wheeler generators. The gas plant is similar to but larger than that of the United States Government testing plant at St. Louis, which has been in continuous operation now for two years or more making gas successfully from all kinds of coal. The engine plant is similar to but smaller than the plant of the Lackawanna Steel Company at Buffalo, where a larger number of the same engines has been running successfully on blast furnace gas.

The Medford plant has been run very little, owing to the desire to thoroughly work out the exhaust question before putting the plant into regular operation. The station is in a residential district, and the noise of the exhaust of the one engine started was such as seriously to annoy the neighbors. The plant, therefore, has been experimented with for nearly two months, during which time only one engine has been run, and that very little, so that no economy tests have been possible.

The equipment of the Sommerville station consists of a Loomis-Pettibone gas plant, with the necessary exhauster, scrubbers, holders, etc., American-Crossley engines and Crocker-Wheeler generators.

The Sommerville station has been in commercial operation since May 4, 1906, and up to August 31 it has used 1.45 lb. coal per kw-hour. During May—from May 4 to May 29, inclusive—only one engine was in use. Since then two engines have been running. The station is run week days from 7.00 a.m. to 11.00 p.m., and on Sundays in the afternoon only. The engine load factor has been about 74 per cent.

On June 10 a 30-days' test run was begun. During these 30 days the station was run 16 hours per day, from 7.00 a.m. to 11.00 p.m., with an engine load factor of a little over 70 per cent. The average Pocahontas coal per kw-hour delivered from the station was 1.31 lb. This included all the fuel used, whether for running the engines, building fires after cleaning or in the auxiliary boiler.

From May 4 to September 3, inclusive—the four months in which the station has been in regular commercial operation—the fuel per kw-hour output has been 1.45 lb. These figures are as good as the most enthusiastic have ever hoped for. The plant has proven its reliability, and the shut-downs have been very few. There have been no shutdowns of any kind in the gas house. This portion of the plant has run regularly and without any trouble and has made a uniform grade of good gas.

In the engine room there have been interruptions, but these have almost all been of the kind to which any new power plant is subject. The longest delays, in fact the only real shutdowns, were due to improper water connection with the piston. This matter, however, has been remedied. There has been one case of hot crank pin, probably due to too quick starting. These engines can be set running so quickly—well inside of 60 seconds, and often close to 30 seconds—that the temptation has been to see how quickly it could be done, resulting, as before stated, in one case of hot crank pin, the oil not having been given time to reach it after six hours' shutdown.

As a result of experience with these plants, Mr. Windsor stated that he is absolutely convinced of the economy and reliability of a gas engine power station. The fuel consumption will be about one-half as compared with a steam plant, running from less than 1.5 lb. to 1.75 lb., according to the load factor and almost regardless of the size of the plant, as against three to four pounds in similar steam plants.

The cost of the gas plant, including producers, is undoubtedly considerably higher than the cost of a similar sized steam plant, and whether the fuel saved will justify the increased capital depends on the price of coal; but it seems that with coal at $3 and upwards, there will be a material net saving by the use of gas.

Another advantage of a gas plant is the high efficiency of a small plant, the efficiency being practically the same for engines as small as a couple of hundred horse-power as for those of larger size, which of course is not true of a steam plant.

The question is of course asked: "What are the disadvantages of a gas power station as compared with a steam plant?" Mr. Windsor states that they are few. The gas-producing portion of such a station is simpler, easier to operate, and holds its efficiency better than a steam plant. The losses from banking fires are extremely small, and the plant can be gotten into service much quicker than can a steam plant. It is the practice to shut down at 11.00 at night and start at 7.00 in the morning. Fifteen or twenty minutes are required to get the gas plant into full operation, while of course with a boiler plant it takes from one to one and a half hours to get the fires into first-class shape. The ashes must be periodically removed from the producer. In the Boston plant this must be done while the producers are out of commission and takes about three hours twice a week, although the plant can be run a couple of days longer without cleaning, if necessary. The wet and dry scrubbers must be cleaned every few weeks, but this work is certainly no more difficult than the work required around a boiler, cleaning soot from the tubes and from the soot chambers.

An ordinary gas man, such a man as would be considered a first-class fireman, can run at least as many horse-power of gas producers as he can of boilers. He can make a very uniform grade of gas and will get regularly very much nearer the possible efficiency from the gas producers than from the boilers. The Ardos Co.'s CO_2 recorder has been found of great assistance. It is, of course, much more satisfactory for a man to know actually what he is doing from minute to minute than to rely entirely on his judgment.

The ordinary steam engineer is, of course, afraid of a gas engine, just as a stationary engineer is afraid of a locomotive, but a few months' practice should make of a good steam engine runner an equally good gas engine runner. The handling of the water jackets is, of course, extremely simple. The problem comes

in the ignition, but with a well-designed gas engine, equipped with a duplicate system of igniters, there would be little, if any, trouble.

A gas engine will hold its efficiency much better than a steam engine. With a steam engine poorly set or leaky valves will interfere seriously with its efficiency. With a gas engine the effect of improper ignition or valve setting, or even leaky valves, is generally either to cause a knock, therefore at once announcing itself, or to reduce the output of the engine. None of these things materially affect the efficiency without showing also in other ways.

The water required is considerably less for a gas plant than for a condensing steam plant and considerably more than for a non-condensing steam plant. A non-condensing steam plant will use for all purposes from forty to fifty pounds of water per kw-hour. A condensing steam plant will use from twenty to thirty pounds for steam, and from six hundred to nine hundred pounds in the condenser per kw-hour. A gas plant will use about two hundred pounds per kw-hour.

Premature ignition and back-firing have both given a good deal of trouble, and on both types of engines have at times been bad, so bad as to materially reduce the engine power for the moment. This trouble is now much less than it was, and even if not further eliminated will not interfere with the regular and commercial operation of the plants.

CURRENT NEWS AND NOTES.

THE TELEKINO.—A special cable dispatch from Bilbao, Spain, of October 8 says: "Senor Leonardo Torres Quevedo, the inventor of the "Telekino," an electrical apparatus for directing from land the movements of vessels at sea, who is now in Bilbao, was asked by King Alfonso to make experiments with his invention from Giralda. The apparatus was placed on board the royal yacht and Queen Victoria who had seen the "telekino" before followed the trials with great interest. Her majesty told the inventor what movements she wished the boat to make, and Senor Torres Quevedo, carrying out her instructions, caused the craft to turn or stop with admirable facility. Finally the craft was brought alongside the Giralda, and their majesties congratulated the engineer on his invention."

WRECKING A PLANT.—The report of Superintendent Pollizter of the water and light plant, of Fitzgerald, Ga., for September, discloses the fact that some miscreants, at three different times during the month, had deliberately attempted to wreck or seriously damage the plant, which is owned by the city. Had they been successful there would undoubtedly have been injury to persons as well as of property. Upon two nights an effort was made to let the water out of one of the boilers, and the night engineer fired four shots at the fellow who was caught in the act, during the second attempt. Unfortunately, he proved a poor shot. Later the engineer found the journal boxes of the dynamo filled with sand. After this the assistant engineer resigned, stating that he did not feel that his life was safe. Since that time no one has been allowed about the plant without a permit. On several occasions arc lights have been shot out and ropes cut, allowing the lamps to fall and break. Although suspicion points to certain parties animated by personal or political motives, no arrests have been made.

METRIC IN ENGLAND.—A cable dispatch from London of October 16 says: "Kynochs, Limited, the well-known Birmingham manufacturers of ammunition and explosives, announce that they are tired of awaiting legislation establishing the metric system in Great Britain and that they have decided to be the first great British firm to adopt that system. Arthur Chamberlain, brother of Joseph Chamberlain, who is managing director of Kynochs, says that the change will be surprisingly simple, involving only the alteration of the scales on the arms of weighing machines and the simplification of account books. Instead of eight or nine columns for weights and three for money there will be wanted only two columns, one for weights and one for values. Wages will be calculated in decimals and translated afterward into pounds, shillings and pence. Officials of the Decimal Association say that British manufacturers are losing millions annually in their dealings with countries using the metric system by not adopting it. A renewed attempt will be made at the coming session of Parliament to pass a bill for the compulsory adoption of the system."

UNPOPULAR LAMP POSTS.—The following bit of correspondence in the Pittsburg *Dispatch* touches upon an undoubted fact, but it would be of interest to know the real explanation. In suburban and rural districts, it is said, the objection to a friendly adjacent light does not apply: "It is amusing how shy some residents in the fashionable districts of New York are of lamp posts. The most unpopular house in a block is usually the one whose front door is on speaking terms with the lamp post. This retiring disposition could be understood if Gotham's Weather Bureau furnished nothing but June zephyrs the year round and the population was made up of young couples given to spooning on the front stoop, but when the fact is taken into consideration that a large number of the anti-lamp cranks consist of staid married folk whose romantic days are over, and children whose mushy period is still to come, the peculiarity is hard to explain. Renting agents say they frequently encounter this prejudice in letting houses. The prospective tenants will inquire if the house is opposite a lamp post, and when the agent answers in the affirmative the house seeker goes elsewhere beyond the range of a gas jet. Some real estate owners have even gone so far as to petition the city to remove certain lamps because they damage their property."

INDEPENDENT TELEPHONE CONCENTRATION.—The concentration of independent telephone systems in a few hands, and one or two large companies advances steadily, even rapidly. Further details are made public as to the merger recently announced, effected by the American Union Telephone Company. It has just taken over all of the property and rights of more than three-fourths of the strongest independent companies in Pennsylvania, Southern New York, Northern Virginia, Maryland and West Virginia. At the same time by traffic agreements the new company acquired long-distance connections over one-third of the territory of the United States, including more than one-half of the country's population. The new combination, which is capitalized at $25,000,000, will begin work immediately on extensions, connections and improvements to develop these fifteen separate companies into one complete local and long-distance system, which will be the most extensive independent system in the country. Heretofore none of the companies included in the merger, on account of restricted territory and limited capitalization, has been able to equip its lines for long-distance service, but the reports made to the new company show that these constituent lines have been doing a toll business approximating $200,000 per annum. All of these lines will now be equipped with the latest improved devices.

HEATING FROM PEAT.—A proposal has been made by the Brockton (Mass.) Peat Fuel & Heating Company to furnish heat electrically in that city. Right to erect poles and conduits is asked. The plan is thus outlined: "It is the purpose of the company at first to manufacture peat for sale as a fuel. It is the further intent of the company to locate a plant on the peat bog and generate electricity at so low a cost that it can be supplied to houses and business places for the purpose of heating and cooking at a price that will be cheaper for the householder than to use coal, and it is the desire of the company to run wires through the streets to allow it to work out this proposition. There are peat bogs in and around the city suitable for the purpose contemplated, although the exact location of the plant is not yet determined. That heating and cooking by electricity is perfectly feasible has been demonstrated in street car use and in its use in large bakeries, and by the fact that the water power of Niagara Falls is furnishing such service to householders in that section. There is a company about to start manufacturing in Norwood and the Brockton company will be the second to use the machinery for processing the peat into commercial fuel. By the location of a power plant on the peat bog there will be no cost of transportation and fuel will be as cheap for use as though the plant was located at the coal mines."

ADELAIDE, AUSTRALIA, TROLLEYS.—The electrification of the tramways in Adelaide, Australia, is now assured, the company owning them having accepted the Government's terms for their purchase at $1,400,000. Governor George Le Hunt states that the lines will now be electrified as rapidly as possible.

GERMAN WIRELESS STATION.—Advices from Berlin give further data about the wireless signal station now in course of erection at Norddeich for the German Government postal authorities, which will have an effective radius of 932 miles, equal to the distance from Naples to St. Petersburg. The station consists of four iron towers 213 ft. high carrying the antennæ.

PUBLIC POLICY COMMITTEE.—The committee on public policy of the National Electric Light Association, consisting of Everett W. Burdett, chairman, and Messrs. Henry L. Doherty, Charles L. Edgar, Samuel Insull, J. W. Lieb, Jr., Jos. B. McCall, Alex. Dow and Samuel Scovil, held a meeting at the Waldorf Astoria, New York, October 11. Mr. W. H. Gardiner, Jr., has been appointed secretary of this committee, which is one of the most important committees of the association.

CANADIAN POWER DEVELOPMENT.—At a recent meeting of the Canadian Hydro-Electric Commission Hon. Adam Beck, the chairman, stated that the applications for horse-power totalled considerably larger than the amount which the Hydro-Electric Commission gave as an estimate. So far applications have been received for about 68,000 hp, while the estimate was for between 60,000 and 65,000 hp. A greater number of municipalities than was expected are applying for power.

LARGE SUBWAY SCHEMES.—In a communication sent to the Board of Estimate the New York Rapid Transit Commission has approved, except in one particular, the plans of Borough President Coler of Brooklyn for a tri-borough subway to run from Pelham Bay Park, in the Bronx, to Coney Island by way of Manhattan and the new Manhattan Bridge. If the Board of Estimate approve the plans bids will be asked for on the construction. The cost of the work is estimated at $57,000,000.

JUMPING FRANCHISE VALUES.—The New York State Board of Tax Commissioners has completed the valuation of special franchises operated in this State. The aggregate valuation is $427,951,459, as compared with $356,829,555 the aggregate last year, or an increase this year of $71,121,904. The aggregate of the valuation of special franchises in Greater New York is $361,479,300, as compared with $302,195,550 last year. In Albany County the total is $4,698,855, against $3,675,249 in 1905; in Erie, $14,881,320, against $14,147,610; in Monroe, $8,897,795, against $6,246,970; in Rensselaer, $2,331,735, against $2,045,685; in Westchester, $6,377,055, against $5,181,105.

ELECTRIC STEEL MAKING.—Jacques Thibeau, of La Louviere, Belgium, in the *Revue Universelle des Mines*, refers to the rapid progress which the use of electricity is making in the manufacture of steel. Among the recent installations operated by blast furnace gas are a furnace of 1,200 hp, making 40 tons of steel per day, at Dudelange, and one each of like capacity at Forges d'Eich and at Roechlings, Voelklingen, the latter for rail steel. In five months the Société des Procédés Gin has received orders for furnaces for 4,000 hp for the Krupp Works at St. Léger, France; for 4,500 hp, for Sastago, Spain; for 7,000 hp for Petrozseny, Hungary, and for 12,000 hp for Italy. No confirmation is offered of these figures, which are certainly quite striking.

THE TANTALUM LAMP.—The following important announcement is made to its customers by the New York Edison Company in a circular just issued with the monthly bills: The new tantalum incandescent lamp is now available for commercial use. This lamp consumes 44 watts of electric power and gives 22 candles of light. That is to say, giving 37½ per cent more of light it consumes 12 per cent less power. Retail customers of the New York Edison Company are entitled to the free renewal of the ordinary types of incandescent lamps. The new lamp, however, is still far too costly to be included under this arrangement. Its retail price is 60 cents, but this company is prepared to furnish it, in lieu of the ordinary lamp, at the net price of 35 cents. Edison customers purchasing electricity under any of the wholesale forms of contract may supply their own incandescent lamps independently of the purchase of electric energy. The difference is allowed for in the wholesale compared with the retail price schedules. Such customers may purchase tantalum lamps at the net price of 48 cents each.

AUTOMOBILE CLUB SHOW.—That the show committee of the Automobile Club of America's coming exhibition in the Grand Central Palace, New York City, December first to eighth, were justified in holding an early show this year is evinced by the fact that over 60,000 sq. ft. of space has been applied for by manufacturers and exhibitors. Some of the exhibitors may be compelled to modify their demands for space. In addition to automobiles, there will be a very attractive aeronautical exhibition in which everything new and novel in the balloon and airship line will be on exhibition. A feature of this part of the show will be Lieut. Frank P. Lahm's balloon, United States, which won the recent international contest from France to the English coast, and the two balloons Orient and Centaur, which are entered in Saturday's contests at Pittsfield, Mass. The exhibition of commercial vehicles will also be very complete, and it is more than likely that a number of the cars which will take part in the club's test for commercial vehicles on November 7 will also be on exhibition. This is a part of the show in which electricity puts forth its greatest strength.

COPPER MINES.—The total amount of copper in electrical plants, indoors and out, exceeds credibility. The last annual report of the American Telephone Company stated that the Bell companies had in use on December 31, 1905, not less than 320,000,000 lb. of copper wire. The amount of copper wire in use at the end of the present fiscal year will be about 373,000,000 lb., an increase of approximately 53,000,000 lb. during the year. The market value of this wire as copper at current quotations of 20 cents per pound would be at least $75,000,000, or 22 per cent of the entire capitalization of all the Bell companies, including the parent company. In the five years to end next December the Bell companies will have used for copper wire a total of 203,000,000 lb., or at the average rate of about 41,000,000 lb. annually. The annual consumption has shown a steady increase from year to year, which has been strongly accentuated in the last two years, due to the rapid development of the telephone business. But add to this the copper in lighting and railway circuits, in dynamos, motors and other apparatus, and some idea can be formed of the effect that electrical development has had on the copper industry.

STORE WINDOW LIGHTING.—Some sensible and striking remarks are made by the *Merchants' Review* on the subject of the store window and its lighting. The following passage may be quoted: "Architects highly trained and builders skilled of hand combine to produce the modern store window. It is high, it is wide, it is deep, it is well provided with opportunities for admitting abundance of light, the sunlight by day and the dazzling beams of electricity by night, and it is all that could be desired. But if this modern store window fall into the hands of a person without the enterprise or skill to properly utilize it, of what use are its many good points? It might as well be a mere hole in the wall, with a common pane of glass glazing the aperture. No dealer should neglect his show window. His duty to himself, his duty to the public and his duty to the packers forbid the supposition that he is entitled to do as he pleases and make his window a fright. The public is hardly treated when it is deprived of the privilege of feasting eyes upon a fine and sumptuous exhibit of merchandise. The dealer is cheated when the window service is not properly attended to. Let trade's watchword henceforth be: Use the window for all it is worth! Some windows are better than others, but none are worthless. Some displays are better than others, but all have their value. Change is of vital importance."

TELEPHONES IN DENVER.—In New York there are now 250,000 subscribers. As the Empire City has a population of 4,000,000, it has one telephone to every twenty persons. Denver does twice as well as this. Nearly 20,000 names are shown on the latest list in the company's offices. With nearly 200,000 people there is a telephone to less than ten people. This is probably as high a proportion as can be found anywhere in the United States, and, probably, as high as any in the world. It is, of course, natural to find the proportion fall off as the cities compared are of larger size.

PARIS SUBWAY ACCIDENT.—A cable dispatch from Paris, France, of October 12 states that thirty yards of the Metropolitan Subway, near the Buttes Chaumont Park, a section necessary to complete the belt around Paris, suddenly caved in that day. The wildest excitement followed, as it was feared that the neighboring houses would crumble, but by order of the police the buildings were hastily and safely evacuated. The scene of the cave-in is close to the place where the Metropolitan Subway disaster of 1903 occurred. Up to the present none of the endangered buildings has fallen.

CREOSOTED POLES.—In a paper presented at the recent Electric Railway Convention, Mr. C. A. Alderman said that the creosote process had up to the present time been applied to only a very limited extent for the preservation of trolley poles. One objection to the application of the process to such poles is that it increases the conductivity of the pole. The paper quotes a statement by Mr. Crump, of Ford, Bacon & Davis, to the effect that in the case of one plant where the transmission voltage is 3,000 creosoted poles were not used for the reason that the leakage would have been too great at this voltage. Where he does use creosoted poles the spans are doubly insulated in the same manner as with steel pole construction.

TRANSPORTER BRIDGE IN WALES.—U. S. Consul D. W. Williams, of Cardiff, writes that the first transporter bridge in Wales was opened at Newport in September. This style of bridge, which is in fact a suspended ferry, was patented by the French engineer M. Arnodin and is intended for use on navigable rivers. The first was built at Rouen across the Seine, and there is one at Manchester, in England. The Newport bridge has a span of 645 ft. and a clear headway from high water of 177 ft., to admit of the passage of the tallest masts at any time. The traveling truck, which is 104 ft. long is electrically lighted and propelled by electric motor. There are 30 suspension cables, with a total length of 1,620 yards and a breaking load of 550 tons. The bridge has been tested with a load of 120 tons. Its building occupied about four years and it cost nearly $365,000.

NEW DIVING MACHINE.—United States Consul J. J. Brittain, of Kehl, reports that Joseph Restucci, a mechanical engineer of the Royal Italian Marine, has recently invented a new diving machine, which has proved a success in experimental tests made with it in deep-sea diving. The machine is constructed of iron 1 cm. (three-eighths of an inch) in thickness, and is large enough to contain a man standing upright, leaving him a certain amount of liberty of movement. The form of the machine is cylindrical, with the upper part shaped like a spherical hood. The front of this hood is furnished with magnifying glasses to permit of exploring the bottom of the sea. Two especially ingenious arms in bronze are attached to the machine, the forepart of each being articulated, to enable them to take the place of human arms. The right arm is terminated by a hand possessing fingers, which work exactly like the fingers of a human being. The left arm is finished with a pair of scissors and nippers. The interior of the machine contains a small electric lamp, capable of illuminating a certain space under the water. The diver communicates with the ship escorting him by means of a telephone. A special arrangement for furnishing air permits him to remain under water for a long time. The Restucci machine has already proven its value, for by means of it a Russian ship with a large amount of gold on board, sunk near Balaklava during the Crimean war, has been located.

FOLK ON OWNERSHIP.—Gov. Folk, of Missouri, who in New York announced that he opposed William J. Bryan's ideas on Government ownership of railroads, has announced his plan for railroad supervision by the Government. "Whether municipal ownership is wise or not depends upon conditions in each particular city," he said. "In some instances it is manifestly the proper thing; in others, owing to different circumstances, it might be unwise. The need of more strict laws in the State and Nation for control of public service corporations is manifest. If there were a Controller of Railroads appointed by the President, subject to removal at pleasure, with absolute power to suspend directors or officials of interstate railroads violating the law, to appoint receivers to take charge of the road until its operators could furnish sufficient guarantee of more responsible management, the result should be to remedy evils now existing in railroad affairs. In other words, give the controller of railroads the power over railroads that the Federal Government now exercises through the Controller of the Currency over national banks. The Federal Government could require a license from an interstate railroad, subject to revocation by the controller. What is needed is more plenary power in some official to correct abuses in railroad matters, as in the case of banks. In the Federal Government, as in the State Government, it is a great deal easier to enact laws than it is to enforce them, and the need more than anything else is for more enforcement of law and more power to enforce the law."

GAS ARC LAMPS.—Mr. Bert Mason in a recent paper before the Iowa Gas Association on gas arcs, discussed the question of competition and cost. A commercial department consisting of 14 men located in the State of Ohio, competing with natural gas at 45 cents per 1,000 cu. ft. as against 95 cents per 1,000 cu. ft. for artificial gas, in a period of 90 days installed 1,400 arc lights, 800 of these being natural gas and electric displacements and the remainder increased consumption. To accomplish such a wonderful result arc lights were installed on the following basis: Consumers would sign a contract to pay a minimum charge of $1.50 per month for each arc light installed, this amount to apply on their gas bill. In addition to the above charge the consumer would pay 25 cents per month per arc light for maintenance, and the entire contract would be signed for a period of three years. Simplified, the plan means that the gas company loaned the consumers as many gas arcs as they could use for a period of three years, and sold not less than $1.50 worth of gas per arc light every calendar month during the period of the contract. At the end of three years, instead of renewing these contracts, it would be a very easy matter to sell most of these arc lights as second-hand, for $5 each, just where they are hung. The main feature will be, however, for the gas company to give perfect service in every respect during the period of the above-mentioned contract, and then at the end of three years the consumers will be glad of an opportunity to purchase the arc lights and burn what they like without being tied to a contract at all. Again, some of the above-mentioned arcs were sold on a one-year contract at what they cost the gas company installed, provided the consumer would agree to burn artificial gas for a period of one year. Another good plan for installing gas arc lights, Mr. Mason said, is that of renting them for $5 per year in advance, including maintenance. At the end of the year the consumers can lease the arc for another year at the same figure, or they can purchase and own the arc by paying $5, the gas company crediting $2 of the $5 paid in advance to the maintenance and the balance of $3 for the rental of the arc. If the consumer decides to buy at the end of the first year the company will have received $8 for its arc light according to these figures. If, on the other hand, the consumer decides to lease for another year, the company received $6 for the arc light and $4 for the two-years' maintenance. This money being paid in advance, at the end of the second year they could afford to sell the arcs for $4 to the consumer, and then will have received $10 for the arc and $4 for two-years' maintenance, which gives a total of $14 per arc light, including two-years' maintenance. Out of the total of $14 received on the above plan, credit $6 to the maintenance and still they had a balance of $8 to credit to the sale of the arc light.

The New Power Supply for the City of Lyons, France.

BY C. T. WILKINSON.

THE attention of those engaged in the study of the problems connected with the transmission of electrical energy over long distances has recently turned with great interest to the latest work of M. Réné Thury, chief engineer of the Compagnie de l'Industrie Électrique et Mecanique of Geneva, while the recent purchase of the Thury patents for England by one of the most prominent electrical manufacturing companies and the favorable consideration of the system in connection with the much-discussed Zambesi transmission, has aroused considerable comment.

The supply of power to Lyons from the district lying to the northeast has many features of great interest, the general scheme being as follows:

At Moutiers is situated a water power station equipped by the Compagnie de l'Industrie Électrique et Mecanique of Geneva; with the direct-current Thury system. The energy is transmitted 87 miles to a switch house at Sablonnières, which forms the center of a converging three-phase transmission system (see Fig. 2), bringing energy from several other plants—Belgarde, 10,000 hp; Avignonet, 8,000 hp; Lechylienne, 8,000 hp (new station); La Bourne, 5,000 hp. The whole system is under the control of the Société Grenobloise de Force et Lumiere.

These plants supply energy at 26,000 volts, 50 cycles, three-phase, the transformers being delta-connected. From Sablonnières the total energy is transmitted 25 miles to Vaulx-en-Velin by two sets of three-phase lines and one pair of direct-current lines, the total power for Lyons being then transmitted underground by direct current 2.8 miles to Lyons, where in the Rue d'Alsace station it is transformed to 600 volts for direct-current traction by Thury motor-generator sets. The total amount of power provided for Lyons is 75 amp. at 60,000 volts (max.), which is sufficient for present use; but if more is required later it is possible to double the current by changing the connection of the Thury groups in a manner indicated later. The greater part of the power obtained from this district is distributed three-phase with step-down transformers to factories, which are thickly scattered over the district, especially between Sablonnières and Vaulx-en-Velin.

All motors, transformers, switches, line insulators, etc., on the alternating-current system are installed for 40,000 volts, since it is anticipated that it will shortly be necessary to change the whole three-phase system to that pressure, when some new transformers will be supplied and the ones already installed changed from "delta" to "star," the old transmission plants already named being rebuilt.

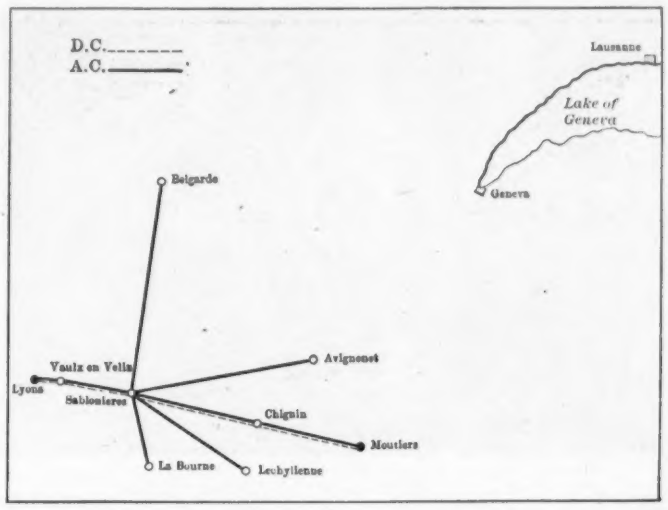


FIG. 2.—MAP SHOWING TRANSMISSION SCHEME.

The direct-current system for high-tension transmission is shown very clearly by the general scheme shown in Fig. 1, which illustrates the electrical connections of the entire system. As will be seen, in Moutiers four Thury groups are employed, each group having two sub-groups consisting of two machines mounted on a common cast-iron base; there are thus four separate armatures in each group. Fig. 3 illustrates the arrangement, though

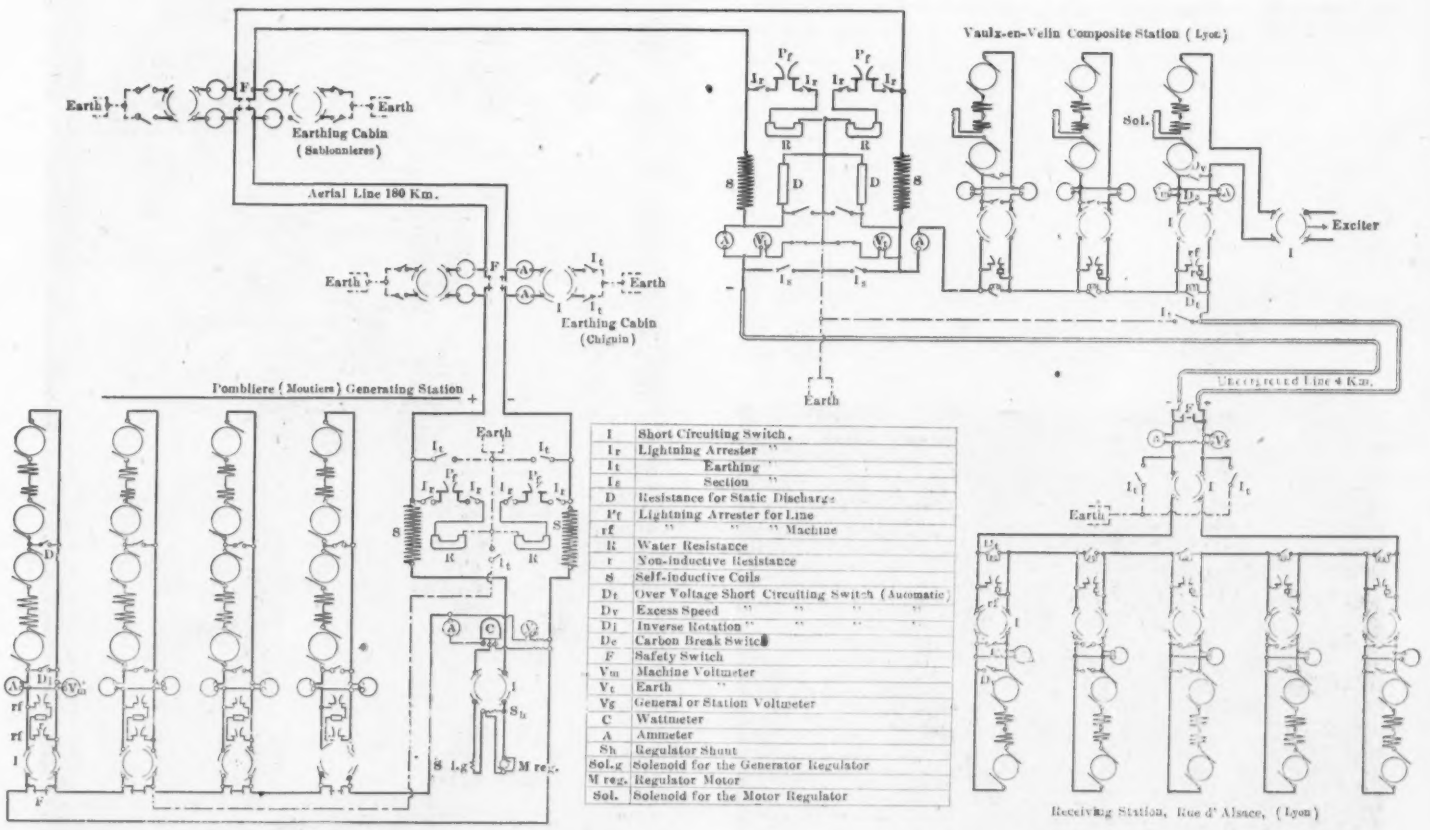


FIG. 1.—DIAGRAM SHOWING INTERCONNECTION OF GENERATORS AND MOTORS.

poorly, owing to the unsatisfactory photograph from which the illustration is made. Each armature has an output of 75 amp. at 300 r.p.m., a maximum pressure of 3,900 volts, and is rated at 400 hp.

Attention should be called to the insulated friction coupling used between the two sub-groups and between the water turbine and the nearest generator. The method of supporting the ma-

FIG. 3.—INTERIOR OF THE MOUTIERS STATION.

chines with bolts resting on insulators is also shown in Fig. 3, and again in Fig. 4.

It will be seen that all groups are connected in series, the positive line then passing through the regulating switch and regulator (general scheme, Fig. 1), and through the induction coil of the lightning arrester, outside of which are connected across the horn arresters with resistance. It will be noted that the center point of the four groups passes to an earthing switch and that separate earthing switches are also provided for each line.

The switchboard, the remarkable simplicity of which is the most striking feature on entering a Thury station, contains only one ammeter, one voltmeter and one watt-hour meter, which latter registers the total output of the station; and one switch of the standard Thury revolving type for the regulator. It is of interest to note that the switchboard for the regulator is situated entirely in one side of the line, and that the total pressure drop across the switchboard, regulator and regulator motor is approximately only six volts.

Leaving the Moutier station the line passes to the first earthing station at Chignin, where the sections between Chignin and Moutiers or Chignin and Sablonnières may be grounded. This cabin contains only two switchboards, both duplicates, the exact

FIG. 4.—INTERIOR OF THE VAULX-EN-VELIN STATION.

arrangement being shown in Fig. 5. The earthing cabin at Sablonnières is situated 25 miles from the Vaulx-en-Velin station and contains in addition some switchgear for disconnecting in case of necessity the various three-phase lines which converge at that point. It is intended to operate this system with the center point earthed and the two lines insulated. In case of accident, or if it is necessary to replace insulators, etc., on either the positive or the negative, that line may be grounded and the system then operates with earth return.

It will be noticed that the equipment at Sablonnières and also at Chignin contains four ammeters, thus enabling observations to be taken of the current passing either into or out of the switchboard cabin and by the earth or by the wire. By this arrangement it is possible to ground either the whole or separate sections of the line. The earth plates at these cabins simply consist of iron plates scattered over a small area, and wherever possible buried in wet ground, there being not more than 200 volts drop between ground and line when carrying the full current of 75 amp.

At Vaulx-en-Velin the line enters through a lightning arrester chamber containing the same arrangements for lightning protection as are used at Moutiers with the addition of a discharge resistance shunting the horn arresters. A position is also left for the addition of two condensers of one-tenth microfarad capacity, which will be connected on the inside of the other lightning protectors, both having one terminal connected to earth, and the other terminals to the positive and negative, respectively. Two condensers are also on order for the Moutiers station. Below the lightning arrester chamber and on two opposite walls are situated the ammeters and voltmeters for the positive and negative lines, respectively, and the earthing switches shown in the general scheme.

At Vaulx-en-Velin the station contains three groups, each group consisting of two direct-current machines on a common bed plate insulated from earth in the usual Thury manner (see Fig. 4) and coupled to a three-phase alternating-current machine by a coupling consisting of two fly-wheels connected by an in-

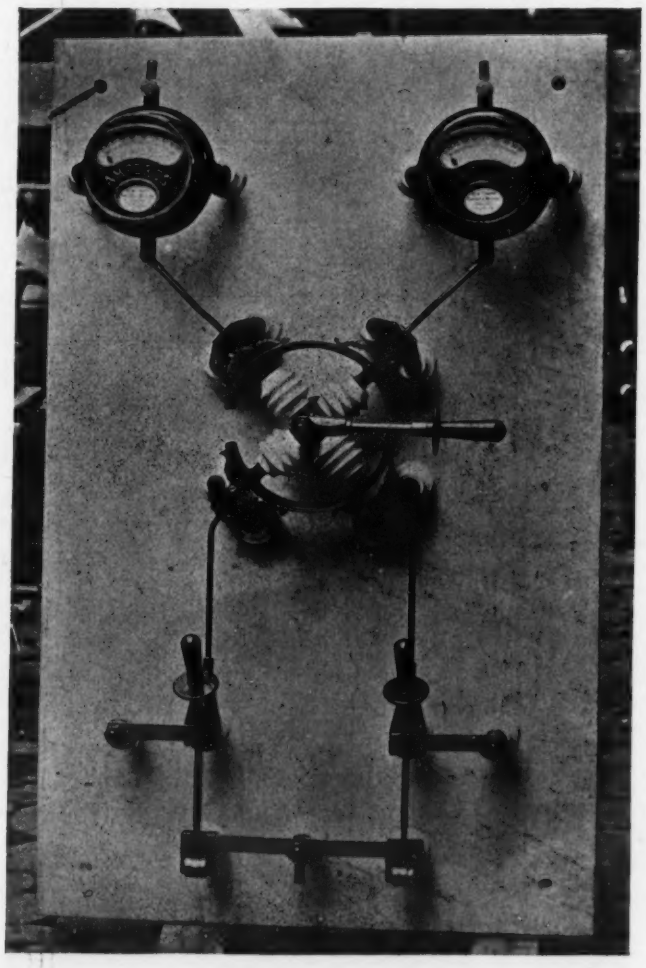


FIG. 5.—SWITCHBOARD USED IN THE EARTHING CABINS.

sulated flexible belt interwoven between projecting studs. The machines, with the regulator, switch tower, etc., are shown in Fig. 4. Each set has a capacity of 800 hp with a maximum voltage of 7,800 across each direct-current group.

The alternating-current machines, which were made by Messrs.

Schneider & Cie, of Champagne-sur-Seine, are wound for 11,000 volts, 50 cycles, this voltage being stepped up or down by transformers, which at present are connected for 26,000 volts. The speed of these sets is 428 r.p.m.

The interior of this station is a striking example of the simplicity of the switching arrangements used in the Thury system. The alternating-current switchboard is mounted on the gallery shown at the top of Fig. 4 and extends over more than half the length of the building, while the direct-current switching apparatus consists of only three simple switch towers, one for each set.

The Vaulx-en-Velin station contains an interesting mixture of three-phase and direct-current apparatus, its function being somewhat complicated, since it acts as a final receiving point for energy transmitted in either form towards Lyons, all of which energy is there transformed into direct current for transmission into the city of Lyons. Some of the Moutier power may also be transformed in case of necessity by these groups, into alternating-current, the Thury machines being then motored, or the direct-current units of this station may be short-circuited, in which case transmission is direct from Moutier to the city of Lyons. In case of a breakdown at Moutiers three-phase energy obtained from the power stations at Belgrade, Avignonet, etc., may also be transformed in this station for use in the city.

There are also installed two special 600-volt, 47-amp., shunt-wound generators, each driven by an induction motor mounted on the same bed plate, one of these machines being used to excite the three-phase apparatus and both in multiple are employed for starting the Thury machines in case of a complete shutdown at Moutier, in which case the incoming line from Moutier is short-circuited.

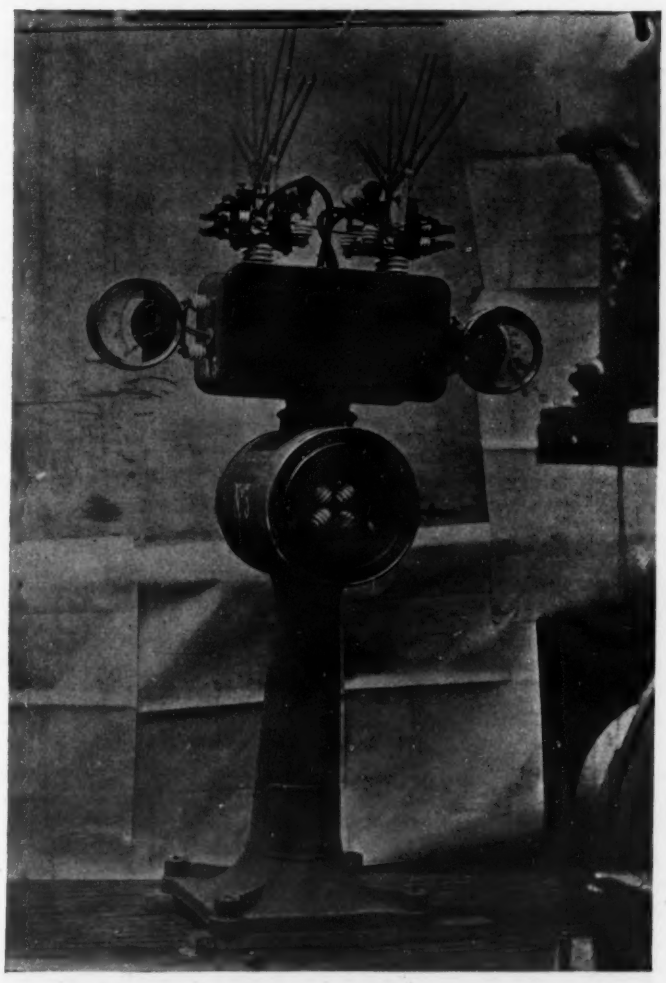


FIG. 6.—SWITCH PEDESTAL USED AT MOUTIERS STATION.

From Vaulx-en-Velin power is supplied to Lyons by underground cables to the Rue d'Alsace station, where the entering line passes to five Thury groups through a main switchboard containing an ammeter and voltmeter and switch. At present only three of these groups are in operation, the fourth being in course of erection and the fifth not yet supplied. The arrangement of this station has nothing unusual, the groups being arranged in a row down the station. Each group is separated by an open space containing the switch tower and is surrounded for about 5 ft. by an insulated flooring.

Fig. 7 shows one of the semi-groups for the Moutier station erected ready for test in the workshop of the Compagnie de

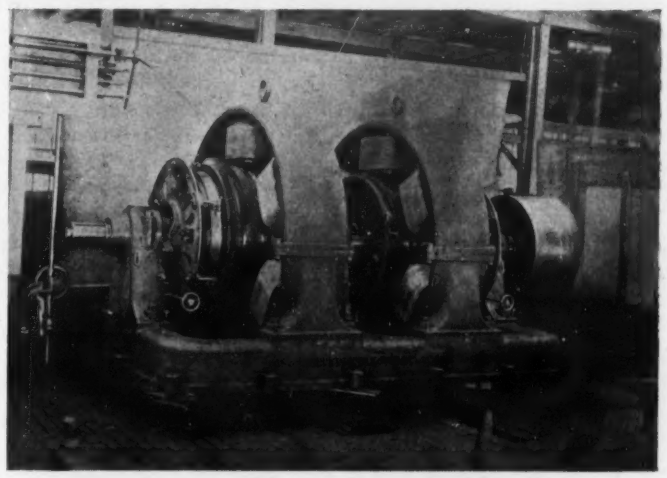


FIG. 7.—A SEMI-GROUP FOR THE MOUTIERS STATION.

l'Industrie Électrique et Mecanique at Geneva, the two machines being mounted on one bed plate, as shown, having a rating of 75 amp., and 7,800 volts at 300 r.p.m. From this picture it will be seen that M. Thury has at last departed from the built-up style of frame usually associated with his name and adopted a standard round pattern.

The cables used for transmission from Vaulx-en-Velin to Lyons are normally designed for 25,000 volts alternating current

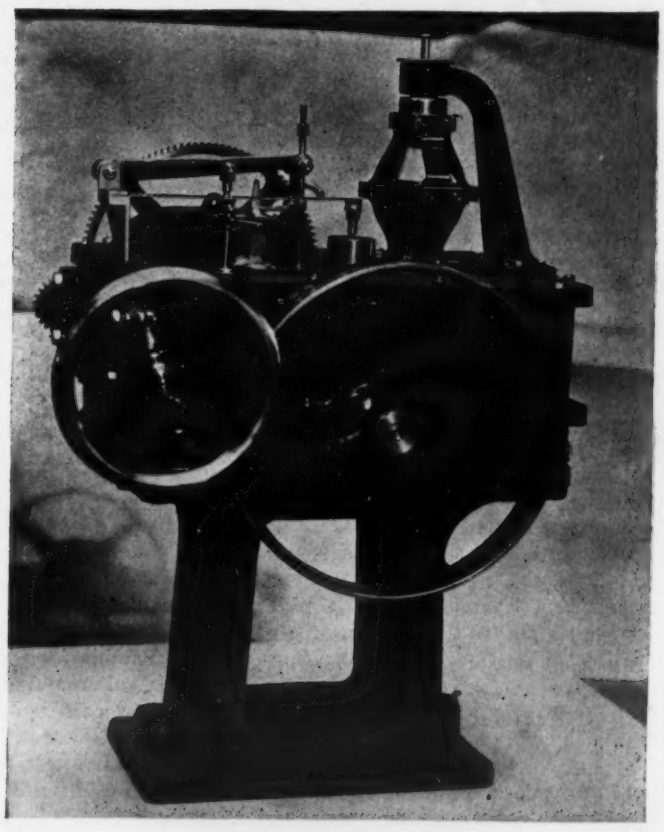


FIG. 8.—REGULATOR FOR ONE GROUP, RUE D'ALSACE LYON.

A test at 75,000 volts alternating current for 15 minutes was specified, but when the test was made the heat of the dielectric became excessive at that voltage and the high-tension test was, therefore, made at 60,000 volts for 15 minutes. These cables were manufactured by Messrs. Berthoud & Borel, of Lyons.

They are called 50,000-volt, direct-current cables and consist of 19 strands with a total sectional area of 75 sq. mm. The diameter is six centimeters over all and the material used in construction is paper, which is covered with two lead coats and two steel armor coats. Tests were made on this cable at 70,000 volts direct current between armor and core on a 100-meter length, but no current reading whatever was obtained on a meter with a scale of .002 amp.

A short-circuiting switch is provided outside all the apparatus at the Lyons station in case it became necessary to cut out entirely that station, similar switching arrangements being made at all the other stations. The frequent use of these short-circuit switches in so many parts of the system is necessary to enable the cutting out of any part or unit for cleaning or inspection without interrupting the circuit.

The line insulators, which were supplied by the Karlsbader Kaolin Industrie Gesellschaft, are of porcelain constructed in three pieces. The height over all is 21 cm., the diameter of the three petticoats being 22 cm., 11 and 6½ cm., respectively.

In all of these stations the high-tension, direct-current machines

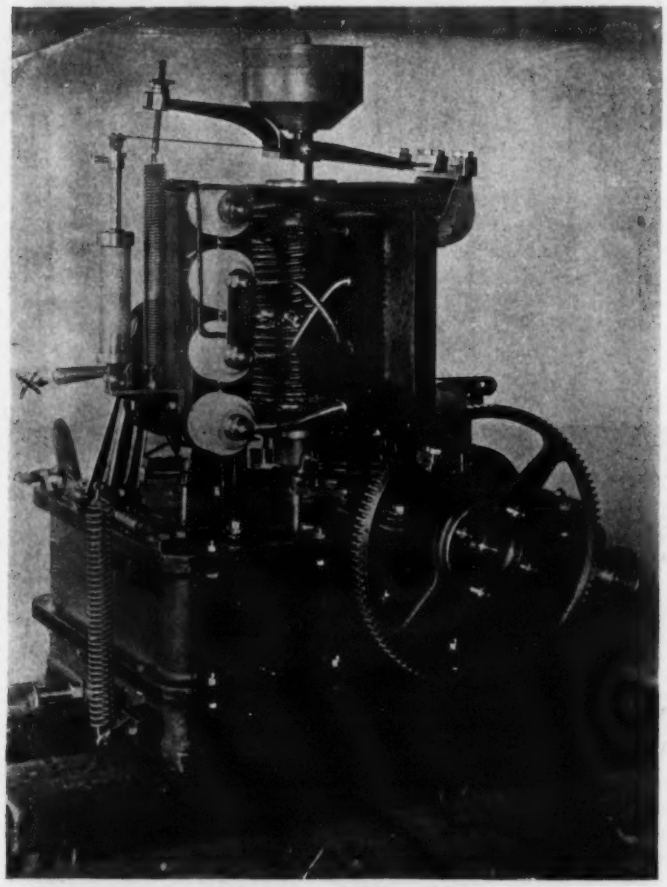


FIG. 9.—REGULATOR FOR ONE GROUP, VAULX-EN-VELIN.

are surrounded for a distance of approximately 5 ft. by an insulated floor, the upper layer consisting of pure asphalt 1 cm. thick; the next layer is of asphalt mixed with small stones and 1½ cm. thick, the next layer being the concrete foundation.

It is interesting to note that M. Thury's tests show this foundation to be capable of withstanding 80,000 volts alternating current. The generators themselves are mounted on cast-iron bases, which are supported on iron bolts resting in cup insulators. These in turn fit into a lower receiving insulator which is corrugated to obtain a firm hold on the foundation. The cables are placed in terra cotta ducts laid in concrete.

Fig. 6 shows the new standard switch pedestal used for the Moutier generators. The method of mounting the voltmeter and ammeter is clearly shown and also the insulation of the switch handle. The voltmeter has a 15,000-volt scale and the ammeter a 100-amp. scale. The case between the two meters contains the resistance for the voltmeter.

On the switch pedestal at Lyons only one horn type arrester is mounted. An additional case mounted in the front of the resistance box contains a carbon brake operating mechanically from the main switch which is used when breaking a short-circuit of a direct-current armature, the high induction of which produces a noticeable arc. The horn arrester is found of little use, since the transmission into Lyons is underground, and it is M. Thury's intention to remove it.

The regulators employed in the Lyons, Vaulx-en-Velin and Moutiers stations are shown in Figs. 8, 9, 10, respectively, and are of considerable interest.

The Moutier regulator acts directly upon the water turbines by the line shafting shown in Fig. 3. It controls the whole station and serves to hold a constant current of 75 amp. Both the controlling solenoid and the motor armature are in series with the main line (see Fig. 1), the six volts absorbed being practically all taken up by the motor. The motor armature is shunted so that only a small proportion of the main line current passes through it, and in parallel with both the motor and the shunting resistance is a secondary battery containing three elements. This small secondary battery is provided for operating the motor in case of entire interruption of the direct-current system. It is placed immediately below the regulator itself, the whole being mounted on a pedestal on an insulated foundation.

The connection from the regulator to the shafting passes

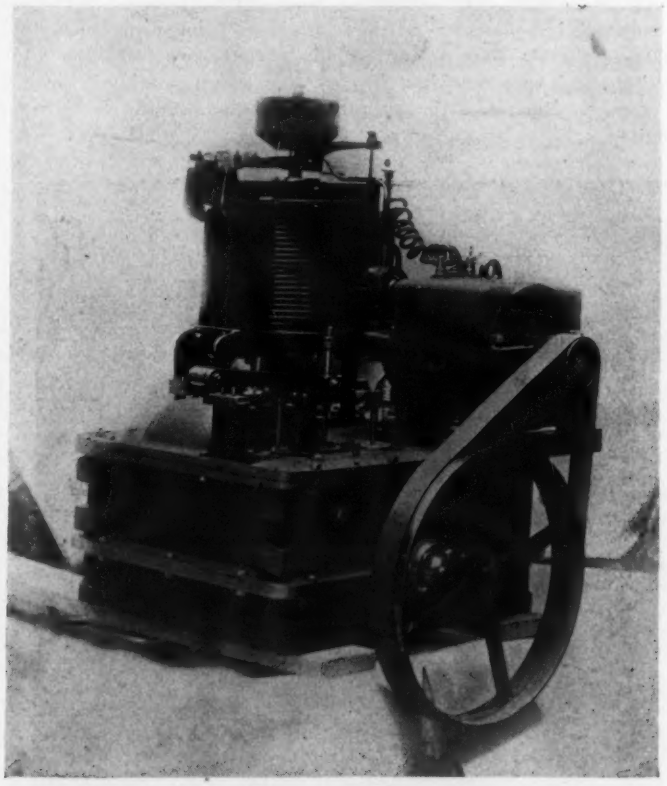


FIG. 10.—REGULATOR FOR THE WHOLE STATION, MOUTIER.

through an insulated joint and another insulated joint is provided at the end of the first length of governor shafting. Two hand mechanisms are provided at different points on the shafting by which the station can be controlled in case of breakdown of the regulator. The operation of the station when controlled by hand with the governor disconnected is extremely simple.

The load taken by each individual turbine is regulated by hand when the turbine is first started, and when the machine takes a correct share of the load it is locked with the main governing shafting, which operates the main water opening through a pilot valve and oil pressure.

The Vaulx-en-Velin regulator is specially built to perform two functions. It can regulate (1) for constant current when the Thury machines are operating as generators driven by the synchronous motors at constant speed; (2) for constant speed when the Thury machines act as motors driving the three-phase machines to supply energy to the three-phase system.

Referring to Figs. 4 and 9, which show the front and back of this regulator, respectively, the latter shows the side which con-

trols for constant current, the leads entering and leaving by the top and bottom studs of the solenoid which are mounted on insulators. The armature of the solenoids must maintain a balanced position corresponding to a magnetic flux in the coil produced by a current of 75 amp.; any deviation in this position—caused by change in current up or down—causes either the positive or negative cam to engage with the ratchet wheel and the motion is transmitted to the brushes by means of the geared wheels shown in Fig. 9, the brush gearing on both machines being interconnected by means of the rod shown passing through between the poles of the front machine (Fig. 4).

The cams are kept oscillating by means of a shaft connecting the pulley shown in Fig. 4 to the pulley on the generator shaft. When the machine is thrown into the circuit the brushes are in the position of approximately zero voltage, and gradually move forward over the voltage angle as the load increases.

Fig. 4 shows the part of the regulator which serves to maintain constant speed when the set operates with the Thury machines as motors. This is the regular centrifugal governor which operates in the usual way acting on the same ratchets and cams to shift the brushes.

When the Thury machines are operated as motors the collection point corresponding to 75 amp. and zero volts (or no torque) is directly between the poles, and when loaded the torque is roughly proportional to the displacement from this neutral. The centrifugal governor, therefore, holds the speed constant by varying the voltage angle in accordance with the torque demanded, the torque angle of course reaching a maximum voltage position which is 90 electrical degrees displaced from the neutral either clockwise or counter clockwise, depending on the direction of the rotation desired.

If the current is interrupted the small iron armature mounted on a lever pivoted on the right-hand edge of the box (see Figs. 4 and 9), which is retained in a vertical position by the energized spools, is released, and actuated by a spring, flies back, throwing up the controlling weight and causing the regulator to instantly move the brushes to the position of zero voltage. It will also be noticed that each of these governors stands upon a cast-iron box and the moving mechanism is contained in this box, which is kept full of oil.

A point of exceptional interest, and one perhaps not previously sufficiently noted, is the ingenious method of lightning protection used by M. Thury. It will be seen that he uses first ten inductive coils each with 40 turns between either line and earth, also 20 horn arresters in two sets of 10, which may be connected by switches either in series or in parallel for each pole on the line. In addition, at Vaulx-en-Velin and Moutier the usual resistance and static spark-gaps are employed, consisting of carbon pipe resistances packed in a porcelain tube, each rated for 19,000 volts alternating current, and arranged in three tiers, each tier containing six in multiple and being separated from one another by wire fuse and discharging points.

Inside of these somewhat standard protective devices is placed a condenser of 1/10 microfarad capacity for each pole. The theory involved is that should any high peak of induced e.m.f. pass the above-mentioned protection the condensers will absorb it, acting exactly as a short-circuit. M. Thury has employed this scheme before and claims most exceptional results.

The conductor employed on this line consists of a solid copper wire 9 mm. in diameter.

It has been claimed that this system did not offer facility for increase of station capacity without raising the voltage and reinsulating the line and station. The arrangement, however, of the Moutier groups of four armatures into semi-groups of two armatures mounted on a common bed plate and on the same shaft, and the placing of the insulated friction coupling between these semi-groups, makes them independent units, which can be connected in multiple, thus increasing the main line current from 75 to 150 amp., provided the line loss is unimportant (which has usually been the case up to the present, the stations being mostly water power) or where this has been considered in designing the transmission line.

The way in which the Cie de l'Industrie Électrique et Mecanique have overcome in this latest installation the conditions previously considered detrimental to the system is a further example of the ingenuity and resource of Swiss engineers.

The New Engineering Building of the University of Pennsylvania.

During the present week, on October 19, the new building for the Engineering Departments of the University of Pennsylvania is being dedicated with appropriate ceremonies, participated in by the delegates from six foreign governments, the army and navy of the United States and more than one hundred scientific societies.

The new building is the largest of the university group of seventy buildings, having a frontage of 300 ft. and depth of 210 ft. at one end, and 160 ft. at the other. The approximate cost including equipment was nearly a million dollars. It is of fireproof construction and the equipment is of the most modern and approved type. The exterior is of dark brick, with limestone trimmings, and the general architectural treatment is in the English Georgian style. There are three stories, with a basement covering about a third of the entire building, the total floor area being 128,000 sq. ft. The heating is by direct steam, each room being heated by steam coils supplied by a low-pressure steam from the central station, after having been used in the engines. The ventilation is by electrically-driven fans, located in the attic and the basement The system is divided into sections, each with a separate fan and tempering coils, so that only that portion of the building in use has fresh air pumped into it. The fans may be controlled from any room in the building. The building is lighted by electricity, the current being supplied during times of small demand directly from the light and heat station, and when

FIG. 1.—VIEW OF MAIN ENGINEERING BUILDING.

the demand is large, from the local plant in the center of the basement. This plant consists of two 75-hp Westinghouse standard engines and one 25-hp directly-connected to General Electric generators. Steam for the engines is supplied from the central station and after being used by the engines is sent into the heating system of the building as noted above.

The lighting of the halls and library is by 50-cp Meridian lamps. The class rooms are lit by clusters near the ceiling. The drawing-rooms and laboratories are lit generally by 5-amp. enclosed arc lamps with opaque bottom shade and concentric diffuser, placed about 15 ft. apart. The uniformity of the light distribution is very fine.

The basement contains locker rooms, lavatories, machinery for heating and ventilating, storage battery rooms, laboratories for geodetic and hydraulic work, and for the testing of the materials of construction.

On the first floor, adjacent to the main entrance, are the offices of the heads of departments, the east end of the building being devoted entirely to the Civil Engineering Department, and the west end to the Mechanical Engineering Department.

On the second floor is a reference library and reading-room, a students' assembly room, rooms for use of instructors and for lectures and recitations. The rear portion of this floor is devoted almost wholly to drawing-rooms. A room for the use of the engineering societies, a general supply store and the library stack occupy the middle portion. In the east and west wings ample space is assigned to the engineering museums, while the rear of this floor is set aside exclusively for additional drawing-rooms, which, like those just beneath, will have the full advantage of a north light.

A plan view of the first floor is shown in Fig. 2, from which it is seen that accommodation is provided for physical and hy-

draulic testing, instrument testing and for special work in mechanical and electrical engineering. Rooms are likewise set aside for dynamos and electric motors, steam and gas engines, refrigerating apparatus, hydraulic motors, boiler testing, pattern making, wood and iron working, foundry and machine shops, etc. The mechanical laboratory occupies a total floor space of about 14,000 sq. ft., the main portion of the laboratory being 183 ft. long by 54 ft. wide and the smaller portion 40 ft. long by 38 ft. wide. This laboratory contains four gas engines and numerous steam engines varying from a compound of about 35 hp to a small

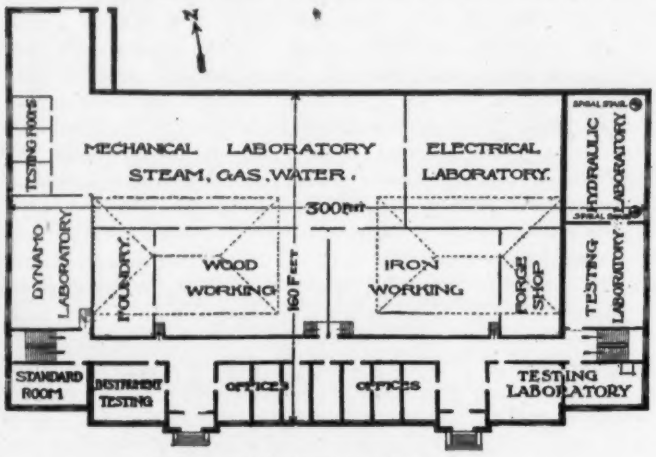


FIG. 2.—PLAN VIEW OF FIRST FLOOR.

De Laval turbine, and a complete equipment of steam auxiliaries.

In addition to the laboratory proper a room intended for the testing of instruments and for making tests of coal, gas and the similar work required of a mechanical engineer, has been located on the first floor. Three small rooms, in addition, are provided, in one of which a refrigerating machine is installed; in the second the apparatus for making tests on blowers and heating appliances, and in the third room apparatus for the testing of radiation through walls of various types.

Four electrical laboratories are provided, three on the first floor and one on the second. The beginners' laboratory, located on the first floor, is intended for measurement of current, resistance, inductance, capacity, etc., the calibration of voltmeters, ammeters, wattmeters, etc., and a floor space of 4,500 sq. ft. is divided into

FIG. 3.—DIRECT-CURRENT DYNAMO LABORATORY.

four separate testing rooms; a concrete table and a galvanometer pedestal is provided for each student, there being accommodations for 42 men divided into four sections. Each of the four sections is provided with its own switchboard and its own storage battery insulation, enabling the entire number of men to be working at the same time. The distributing switchboards have been designed for the work and it is possible to get any combination of direct or alternating current for testing purposes.

The testing laboratory for direct current has a floor space of about 2,000 sq. ft. It is on the ground floor and has all its apparatus mounted on raised foundations to which any dynamo or motor can be attached. Provision is made for handlIng twelve tests at one time and the apparatus for each of these is complete. The distributing switchboard here supplies current at 110 volts or at 6, 20, 110 or 150 volts, or any combination. The main supply is taken from the building plant, 500 amp. being available at 110 volts. All the dynamos used are motor driven, having field rheostats for regulating purposes. The appliances required for making these tests are supplied in such numbers that it is possible to run this entire laboratory at the same time, doing any of the work for which any of the machines may have been installed.

The alternating-current laboratory is located on the second floor. Its total floor space is over 2,100 sq. ft. The wiring in this room is overhead from a switchboard supplied for handling the work here. This board is over 14 ft. in length and all the circuits are protected by circuit-breakers. The apparatus installed is such that each testing place is practically a complete isolated plant. For supplying current four direct-connected generator sets are used, driven by direct-current motors, three sets having polyphase generators and the fourth having four single-phase alternating-current generators.

Two rooms are built especially for students' work in photometry, these having labyrinth entrances and dull black walls. A separate storage battery is provided for handling this work. Each photometer has a three-meter track and universal rotating stand. One is provided with the Lummer-Brodhum screen and one with the Bunsen screen, and a Flicker photometer is provided for use in measuring lights of dissimilar composition.

An instrumental laboratory is arranged for experiments in the measurement of e.m.f. current resistance, temperature coefficient, thermo-electric effect, inductance, capacity and permeability. The calibration of voltmeters, ammeters, wattmeters and watthour meters and the determination of galvanometer constants are also done here by the student. This laboratory has a floor space of over 4,500 sq. ft., part of which is enclosed for an apparatus room. It is on the ground floor and nearly all under skylight. There are also three instructors' offices and a room for the storage batteries for the use of the laboratory. These offices and the instrument room are located in the middle of the laboratory, forming a division of the large room into two parts of approximately equal size. One of these parts is used for senior students and one for juniors. The divisions are each completely equipped for two laboratory sections, which may work simultaneously or at different times.

There is a table and a galvanometer pedestal for each student, there being accommodations for 24 men (12 in each section) on the junior side and 18 men (9 in each section) on the senior side. These tables consist of two concrete pillars each about 2

FIG. 3.—SENIOR INSTRUMENT TESTING LABORATORY.

ft. high, which carry a slab of slate. The pedestals, which are located immediately in front of the tables, are built of one large concrete pillar each being capped with a slate slab at the same height as the tables. This method of construction reduces vibration to a minimum.

The engineering department of the university was established in 1874, but the constant increase of numbers in the classes of the departments has necessitated their moving into more spacious quarters three times since their founding. The departments this year have a total enrollment of nearly six hundred students, and a teaching force of forty. The new quarters which will be occupied this fall are believed to be the finest and most complete laboratories of their kind for instruction in engineering.

Interesting Application of Motors to Existing Machine Tools.

The plant of the F. Wesel Manufacturing Company, Brooklyn, is an interesting example of the wide application of electric motors to existing machine tools. The company manufactures all kinds of machinery used by electrotypers and stereotypers, and a large assortment of tools, etc., used by photo engravers and printers. The factory is located on Henry and Cranberry Streets, Brooklyn, not far from the entrance of the Brooklyn bridge, and is particularly notable in that individual motor drive is employed throughout. The electricity for driving the motors is supplied by an isolated plant consisting of two 100-kw, 240-volt, direct-current Sprague generators direct-connected to two 150-hp Watertown high-speed engines. An 8-panel marble switchboard distributes the energy for lamps and motors to the various departments. In all there are close on to 200 motors in use, the combined rating of which is about 400 horse-power. About 475 16-cp incandescent lamps are in use and eight enclosed arc lamps. The lighting circuits and the motor circuits are fed from separate bus-bars. Adjoining the engine room is a battery room containing a storage battery having a capacity of 40 amperes for eight hours. This battery supplies the energy for the incandescent lamps after the plant is shut down for the night. There is, in addition, a motor-driven T-H alternator, the output from which is used in the electric welding department.

The work done by the company is in general moderate or quite small in weight so that very large motors are not required. The motors vary in size from 1/10 hp to 15 hp, and of the 192 motors in use only 9 are above 5 hp in size. The majority of the motors are ½ hp and 1 hp in size, the number of motors of 2 hp and less in size being 161. All of the motors installed are of the constant-speed type, with possibly a few exceptions, variations in speed being obtained by stepped pulleys. As a rule the work requires an almost constant running on one speed so that it would have been a useless expense to install a motor giving, say, a four to one speed control. Moreover, the wisdom of scrapping existing belt-driven tools which are still serviceable and installing combined motor-driven tools is often questionable. The Wesel company, prior to changing over its outfit, solicited bids for new motor-driven machines and were simply amazed at the prices asked for these machines which were merely standard makes modified slightly to accommodate the electric motor. They found that they could purchase motors on the open market and fit these to their machines for considerably less money than was asked for the combined tool, due allowance having been made for the old machinery. In fact the company found that it would be cheaper for them to buy new tools on the open market and fit these with motors themselves.

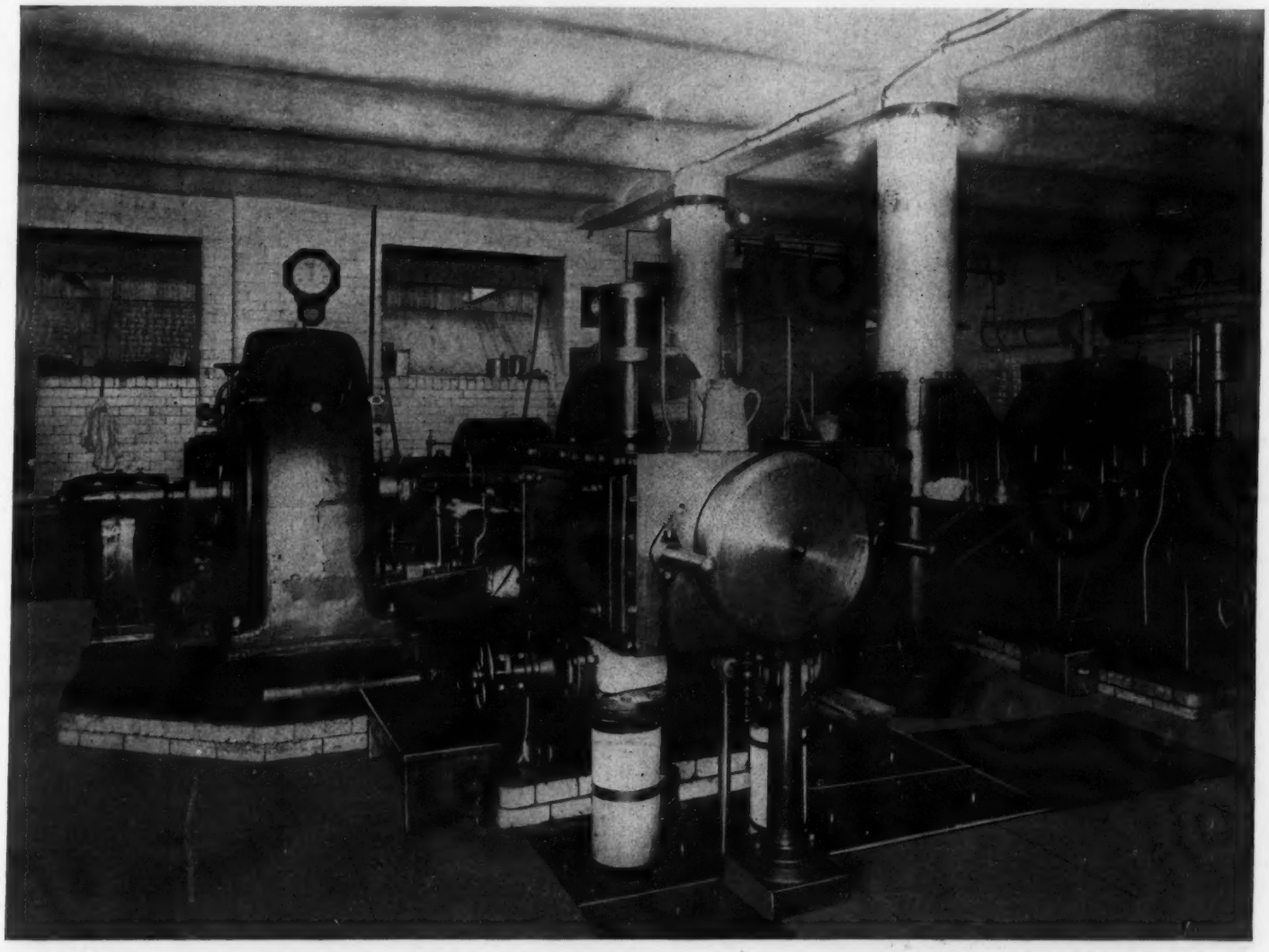


Fig. 1.—General View of the Dynamo Room of the Wesel Manufacturing Company.

Fig. 2 shows a row of milling machines each driven by an individual motor. The machines are staggered in order to economize space and to obtain light from the windows in such a direction that the shadow of the machinist would not fall on the work. Special yokes are fastened to the top of the machines which also serve to support the shafting and pulleys together with the starting box and switches. A separate cut-out is provided for the lamps on the machine and a separate double-pole switch for starting and reversing the motor. Each machine is also equipped with push-button emergency switches so that the machine can be instantly stopped from the work table without waiting to reach the main switch, which is not handy for emergency use. The wires are brought up from the floor below through flexible metallic conduit and the wires from the starting box to

the motor are enclosed in iron conduit. This is well shown in the engraving from which it is evident that the risk of injuring the wires is reduced to a minimum since none of these are exposed except at the switches. Flexible metallic cable is also employed for the lamps. The motors are of Sprague make and enclosed, and the shafting is driven through gearing. In this connection the gain in lighting, space and facility of arrangement due to motor drive should be pointed out. Seven milling machines are placed in a space ordinarily accommodating but five, which is equivalent to a gain in floor space of 40 per cent, not to mention the better light obtainable thereby.

Fig. 3 shows a 16-in. and a 24-in. shaper. The motor is supported on a bracket fastened to the rear of the shaper. Underneath the motor is a bearing through which the shaft driving the shaper runs. This shaft is driven by pinion and gear from the motor so as to cut down the speed. The starting box and switches of the shaper in the foreground are mounted on an elevated support, while the starter and switches on the shaper in the background are mounted on a support at the side. The arrangement of the conduit carrying the wires to the starting box and switch and from the starting box to the motor is clearly shown. Here, again, advantage is taken of the motor drive to stagger the machines in order to obtain the best light possible from the windows.

Fig. 5 shows a 24-in. shaper on which an entirely different style of mounting is used. Two brackets of the shape shown are bolted to the side of the machine and on these is mounted a support which straddles the tool slide and on which are mounted both the motor and the shaft bearing beneath it. A short piece of band iron serves to hold the conduit containing the motor wires. In this, as in other applications, a constant speed motor is used, variations being obtained through the stepped pulley and belt. The arrangement shown here is somewhat better than the arrangement shown in Fig. 3 in that the motor is supported for group-driven machines, while the motor appearing above the shaper and to the rear is used on another tool.

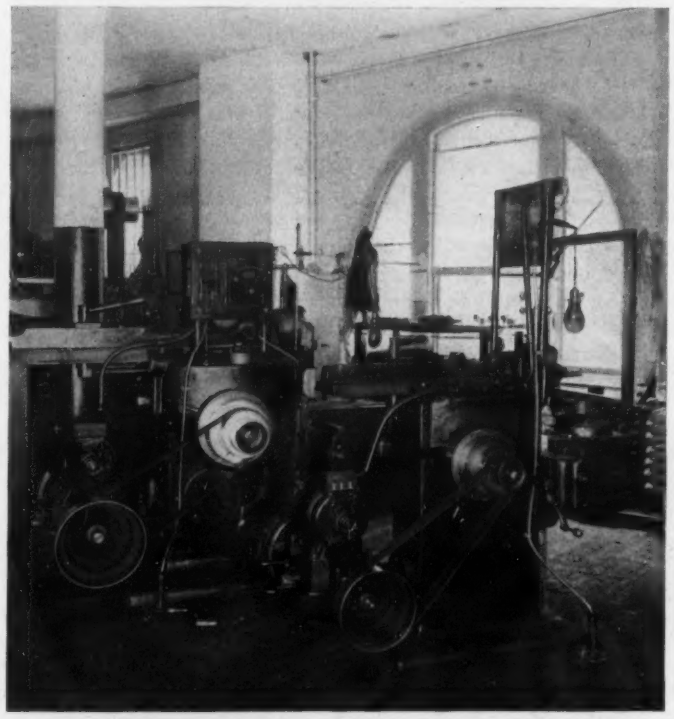


FIG. 3.—ELECTRICALLY-DRIVEN SHAPERS.

Fig. 6 shows an automatic screw machine, to equip which with a motor presented quite a problem as is evidenced by the elaborate support for the motor and shafting. In order to clear all of the mechanism, recourse had to be had to two sectional rings well braced and bolted to the bed of the screw machine upon

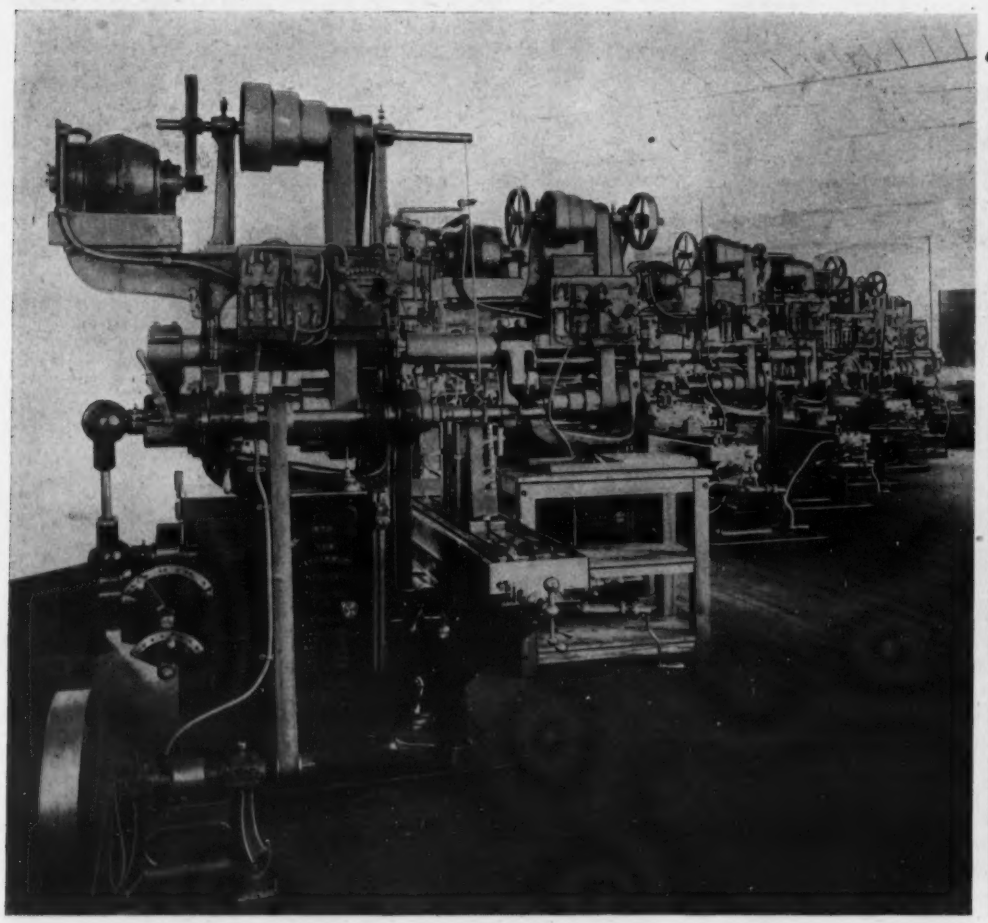


FIG. 2.—ROW OF ELECTRICALLY-DRIVEN MILLING MACHINES.

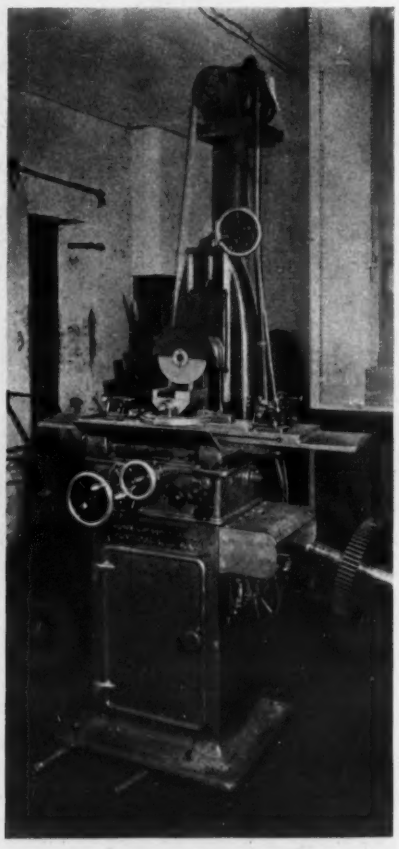


FIG. 4.—SURFACE GRINDER.

above the tool and not in such close proximity to the floor as is the case with the motors mentioned. The motor shown to the right and fastened to the pillar is used for driving shafting

which the motor-supporting bracket was mounted. The wires are brought to the motor through pipe and flexible metallic conduit.

Fig. 7 shows interesting applications of motors to planers.

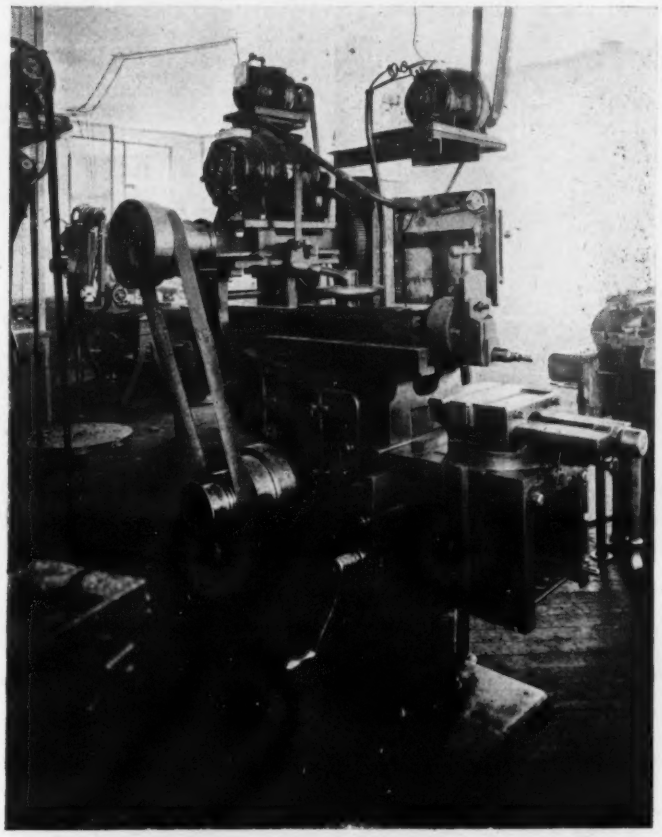


FIG. 5.—ELECTRICALLY-DRIVEN SHAPER.

Brackets are made to fit the contour of the planer uprights and the bed-plate for the motor and shafting rests upon these brackets. The shafting, hanger, pulley gear and pinion are all stock patterns; in fact, the shaft, pulleys and hanger were originally used when the planers were belt driven. The motor drives the tight and the loose pulleys in the ordinary way, the belt on the right serving to raise and lower the cross head. The motor starting box is fastened to the bed plate of the machine. No reversing switch is provided since there is no occasion for these machines to reverse. The illustration also shows the method of hanging the incandescent lamps by means of a swinging piece of conduit fastened to another piece of conduit extending horizontally and free to move in a horizontal plane so that the light may be directed wherever needed. There are many modifications in the method of driving the planers according to the make of the machine, it being understood that various makes of machines are used many of which are quite old though still serviceable.

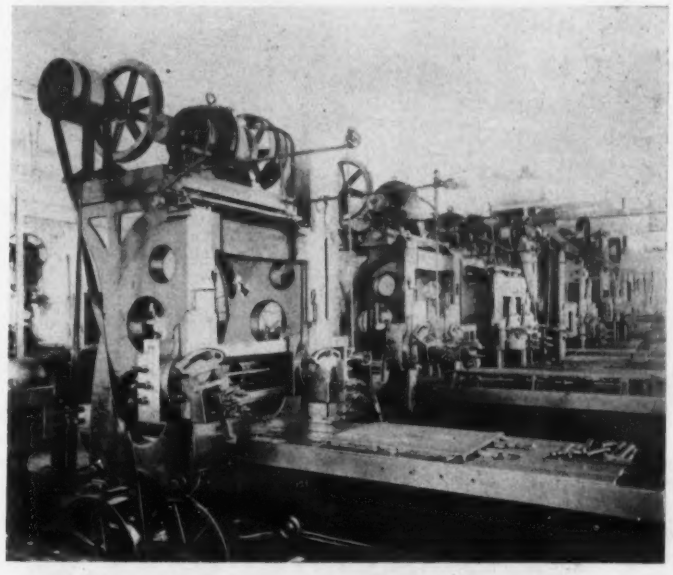


FIG. 7.—ROW OF ELECTRICALLY-DRIVEN PLANERS.

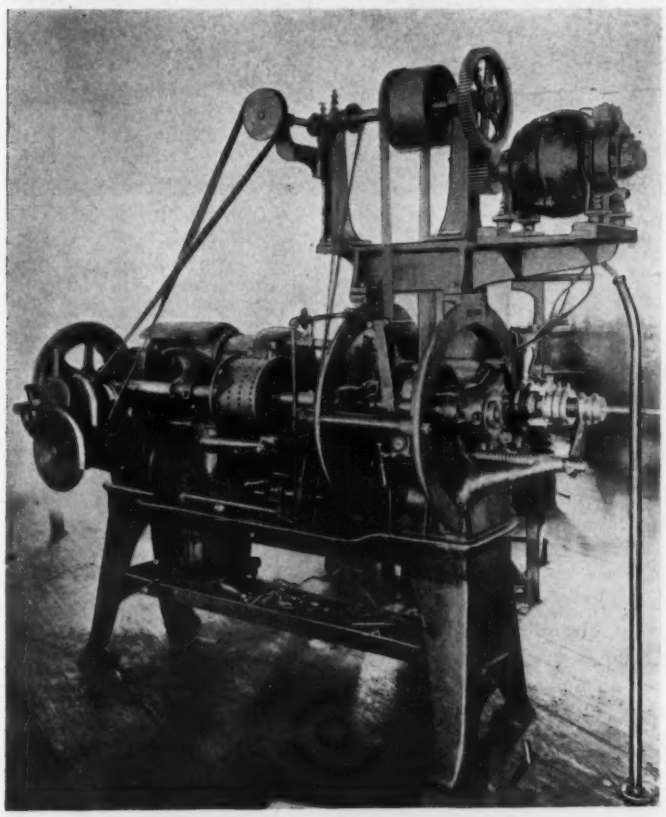


FIG. 6.—AUTOMATIC SCREW-MAKING MACHINE.

Fig. 4 shows a surface grinder in which the motor is fastened

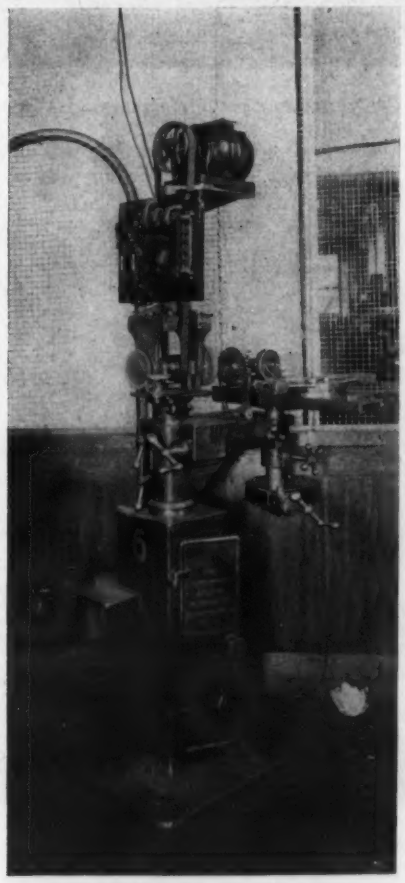


FIG. 8.—TOOL GRINDER.

to a bracket supported by a vertical shaft. In order to get a sufficient length of belt the motor was necessarily elevated quite high. The switches and motor-starter are arranged on the side

FIG. 9.—ELECTRICALLY-DRIVEN DRILLING MACHINE.

of the grinder base and are protected from falling metal by means of the hood shown. The shaft supporting the motor

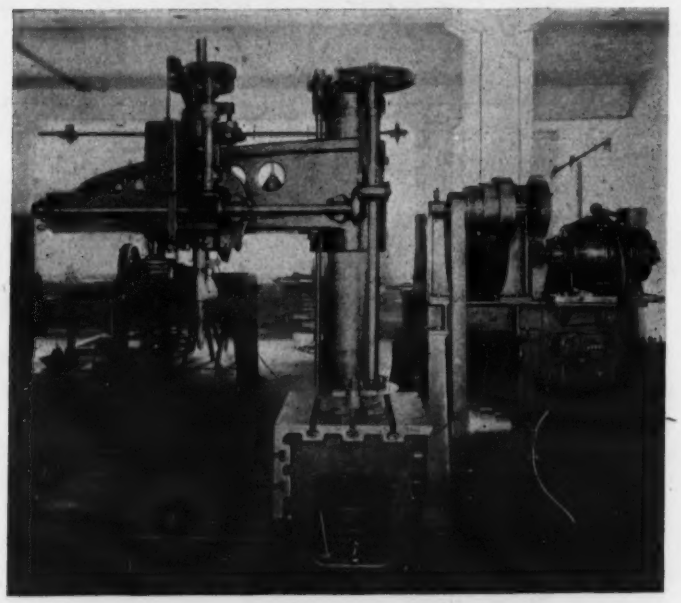


FIG. 10.—APPLICATION OF MOTOR TO RADIAL DRILL.

mounting is fastened to the rear of the grinder by means of a bracket.

Fig. 8 illustrates a tool grinder. In this machine in place of the ordinary cap, a bracket is provided to support the motor mounting. Like the surface grinder it was necessary to elevate the motor quite high in order to obtain a sufficient belt length. The machine is shown wired temporarily from the ceiling, but this has since been changed. In order to take full advantage of the natural light the grinder is set at an angle, as in the case of the milling machines previously mentioned.

Fig. 9 shows a 24-in. drilling machine the motor for driving which is fastened to an extension to the base of the machine. In place of the ordinary pulley a gear is provided which is driven by the motor pinion. The starting box and switch are fastened against the pillar of the drill within easy reach of the operator. The panel is made of slate and is fastened to the pillar by straps. On the small drill press shown to the left, the motor is fastened on a bracket on the rear of the press and drives a countershaft below it in the ordinary manner. Speed variations in both of these machines are obtained through the stepped pulleys. Fault might be found with the method of suspending the motors so near the floor, where dirts, dust and metal might cause trouble; but inasmuch as the motors thus disposed are enclosed no trouble is experienced. The company has sought to obtain a suitable substitution from the old belt drive in the simplest manner possible so that the shape of the machine had a great deal of influence in determining the position of the motor. Where possible all motors have been placed overhead.

Fig. 10 shows the application of a motor to a 5-ft. radial drill. In the original machine the base had two legs spanning the

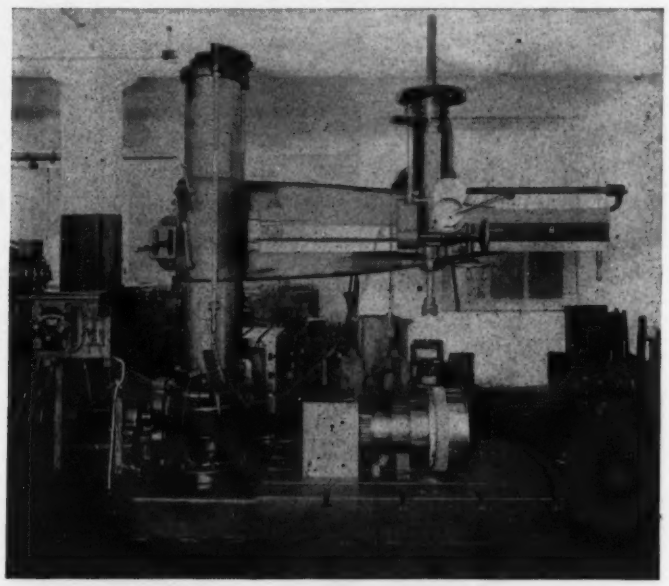


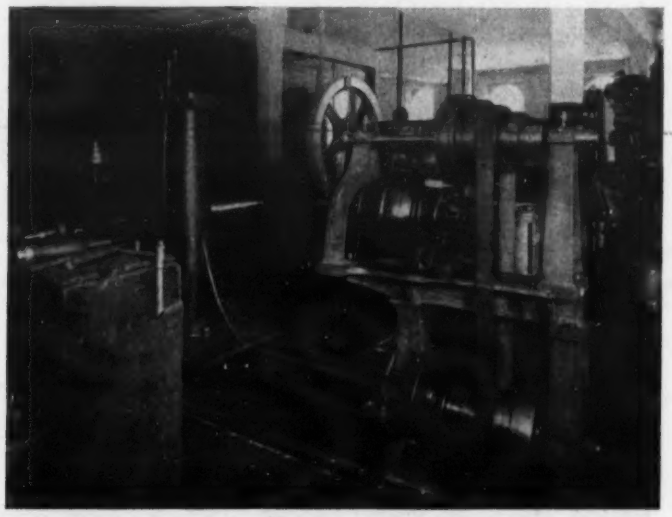
FIG. 11.—MOTOR-DRIVEN RADIAL DRILL.

shaft. These were removed and in their stead was fastened two longer legs serving to hold the original shaft and also to support the motor bracket. A more modern radial drill is shown in Fig. 11. In this case the machine was built for motor drive, the motor being fastened to the base. The main driving gear from the motor pinion is cased in and the rheostat and switch are fastened to a bracket and covered by an iron hood as shown. There is little to choose between the methods employed in driving both these machines. To be sure, one is more compact than the other and were it not for the fact that the company employed a style of mounting which would also be serviceable for other machines in order to limit the number of different parts, the motor connections on the older drill could be much improved. However the height of the motor from the floor in the older drill as compared with the mounting of the motor in the modern drill is an advantage lacking in the latter machine.

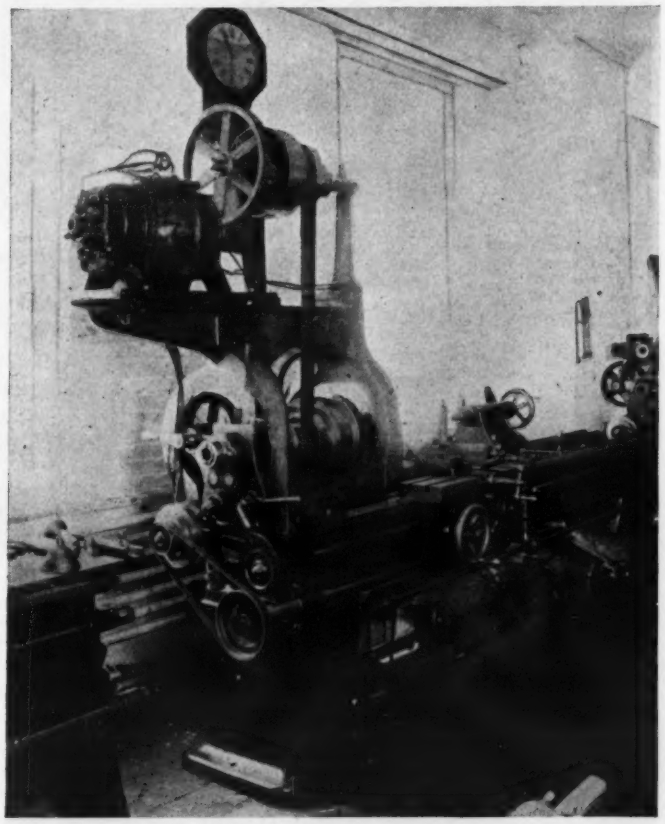
Fig. 12 shows the application of a motor to a 60-in. boring mill. Here an extension is bolted to the bed plate to support the outer leg of the housing, while the inner leg is bolted directly to the upper side of the bed plate. The bracket for the shaft straddles the pinion of the motor, as shown in Fig. 13, which is a rear view of the same machine, making the arrangement quite compact. Only those who have to repair motors can appreciate the care taken by the company to have all the motors

readily accessible and a glance at any of the photographs shows what an easy matter it is to properly inspect and care for the motors in the whole installation.

Figs. 14 and 15 show the application of motors to lathes. In the 24-in. lathe shown by Fig. 14 a peculiar shaped bracket arrangement is employed to support the motor. It is by no means an easy matter to design a casting for supporting a motor on a lathe. Troubles are encountered with the gears. The position of the back gear shaft of a lathe, for instance, is entirely different when the gears are out than when they are in, and where a lathe is plentifully equipped with various gears for screw cutting purposes or for driving feed rods, it may be found that

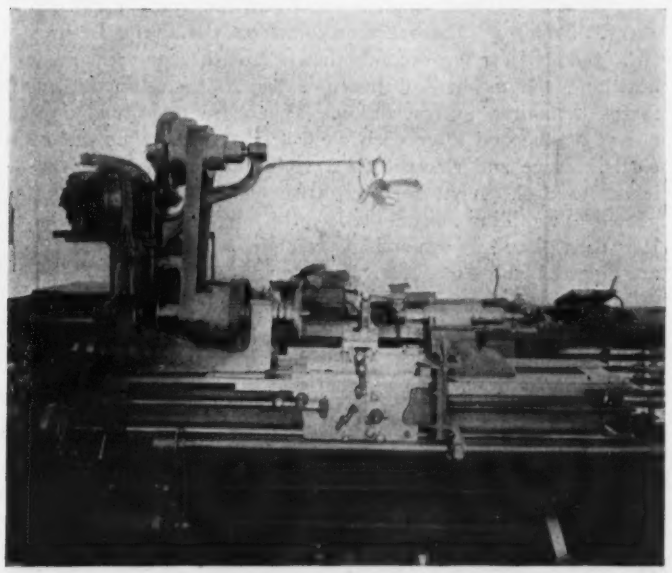


Figs. 12 and 13.—Application of Motor to Boring Mill.



while a casting may fit one combination of gears another combination of gears will interfere with it. It is necessary, therefore, for the designer to carefully examine the entire stock of gears and their application to the machine before designing the casting. In this respect, however, the Wesel company was particularly fortunate. The superintendent of the works, who is a practical machinist, drew a rough sketch of the casting with dimensions. This was given to the pattern-making department of the works and a pattern was made from this rough sketch. When the pattern was completed it was put on the lathe and tried. If it did not interfere with the gears, a casting was made and the motor attached. In this way nearly all of the castings were made and the entire equipment changed from belt to motor drive without interfering with the operation of any machine. The entire change was made by the company's own men and required about a year. No electricians were employed for installing the electrical equipments, as the superintendent of the Wesel plant having acquired a working knowledge of electricity through experience, coupled, of course, with some reading on the subject, superintended the installation. The castings were limited in number and variety so that one type of casting could be used on a number of different machines. This accounts for some of the arrangements where obvious improvements could have been made.

In the lathe shown in Fig. 15 the bracket for supporting the motor is fastened to the hidden side of the machine. The feet rest on the bed of the lathe and the countershafting is supported as shown. This makes a much neater-looking arrangement than that shown in Fig. 14 and is just as serviceable. In both of the tools the controller is placed at the end of the lathe and fastened to one of the legs, the controller handle being on the apron. A splined rod runs under the apron and parallel with the feed screw. Connection is made with the splined shaft by means of a chain, the ratio between the sprockets being such that the angular motion of the lever for complete control of the motor is not too great.



Figs. 14 and 15.—Application of Motors to Lathes.

Fig. 16 shows a rear view of a 48-in. planer. The motor in this

case is fastened to brackets on the side and a plate on the other side supports the shafting which is connected by belt to pulleys at the bottom of the planer. The motor-supporting bracket is stiffened by means of a support from the floor. A rear view of a milling machine showing clearly the construction of the motor and shaft brackets is given in Fig. 17. To the left may be seen one of the push buttons for stopping the machine.

Electricity is used for welding printer's chases and this applica-

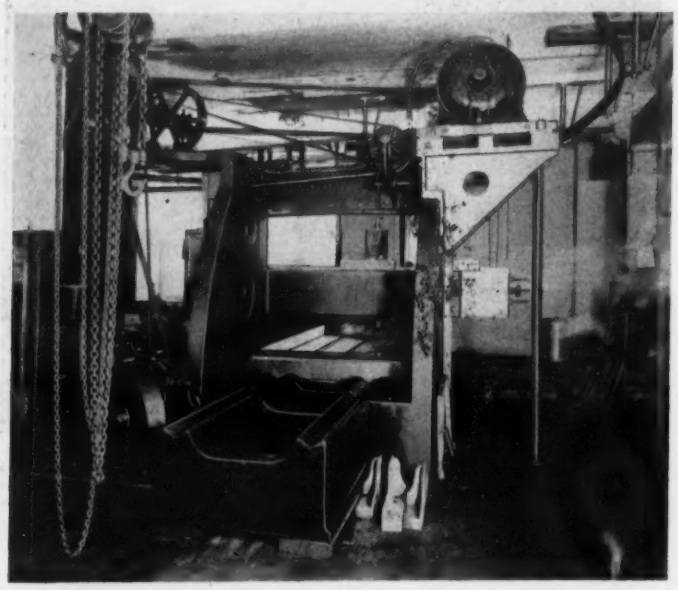


FIG. 16.—REAR VIEW OF PLANER.

tion is an interesting feature of the plant. The chases are made of bars of wrought iron welded together to form a rectangular frame, cross-bars being used in some forms of chase. Owing to the great number of chases of different sizes and shapes in use, it is out of the question to keep any large number of these in stock. Chases can however be made to order very rapidly by means of the welding outfit installed. The iron bars are sawed to length and planed, and with the exception of trimming at the corners after welding this is the only finish the material receives as the process followed in assembling the bars assures sufficient accuracy in the completed chase. Alternating-current at a potential of 320 volts is employed, the average current being 300 amperes. The operator completes the circuit by pressing on a pedal. In a few seconds the ends of the bars reach a white heat and the mechanical pressure which is continually applied forces them into perfect union. The chase is formed one corner at a time and after each weld the bars are taken out of the electric forge and clamped in a right-angle vise, being thus allowed to cool. After the four corners are welded the chase is passed to a milling machine where the bulge of metal is removed. It is then placed in a mortising machine where the inner corners are squared and the outer ones rounded off.

All the wiring in the building is in conduit, the feeders being encased in Sprague iron armor, and the branch circuits being made with B X flexible armored cable. The power plant is located in the basement so that useful manufacturing space is not taken up. Two 150-hp Edge Moor boilers supply the steam for driving the engines. The offices of the company are well lighted by incandescent lamps on chandeliers, no drop lamps being in use. The subway type of incandescent lamp is used and gives a well diffused light. The arc lamps are of the G. E. diffused reflector inverted type. In the pattern shop the motors are all enclosed in double boxes of iron and wood and the motor-starters are enclosed in fireproof boxes. The machinery is all belted to motors. With few exceptions all the motors in use are of standard Sprague make and their operation has been very successful.

In a building opposite the works, the company maintains a show room of no mean proportions. Here many of the machines built by the company are displayed in operation. Each machine is fitted with a motor connected up so that the machine is always ready for demonstration. Much of this machinery is labor-saving, and very interesting. A complete electrotyper's outfit is displayed as well as saws, mortising machines, nailing machines, stitchers, routers, etc. One of the most interesting devices shown is a nailing machine and drill combined. This machine is a great time-saver and insurer of neat work, and is used for nailing engraved plates on wood or metal bases. The machine drills a hole through the copper or zinc plate and drives the nail. The nailer and drill are mounted side by side on a head capable of traveling horizontally an amount equal to the center distance between the two. When pressure is put on a treadle a clutch is released and the drill comes rapidly down and returns, the head moves over and down comes the nailer and pushes the nail home through the hole just made, whereupon the head returns to its normal position. This is all done in about a second. The nail magazine is elevated on the back of the machine, the nails hanging point downwards. A jogging motion is imparted to the magazine which causes the nails to slide in a continuous line down a channel leading to the nailing mechanism. The machine will block plates as fast as three expert blockers working by hand.

It is interesting to note the saving in power due to the change

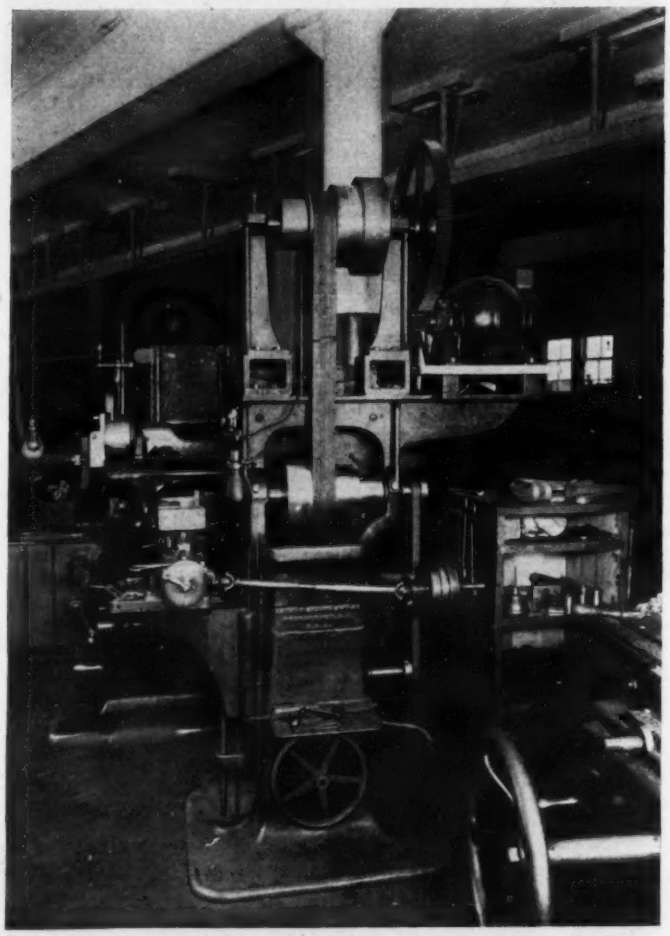


FIG. 17.—REAR VIEW OF MILLING MACHINE.

from belt to motor drive. The average load carried by the generators is about 150 horse-power and the rating of the motors aggregates nearly 400 horse-power. According to the experience of the company the amount of power which would be consumed by the same machines driven from shafting and belts is estimated at 300 horse-power. This does not take into account the welding machines which must be supplied with electricity. The saving in power is thus about 50 per cent, which, added to the better appearance, better service, better light, etc., which go hand in hand with electric drive, shows that all the claims that have been made for electricity as a means of power are well founded.

The Sprague Electric Company, of New York City, made the necessary detailed plans showing the complete electric distribution for light, power, etc., and also gave advice as regard to the control, type and arrangement of motors best suited for the particular service they were to perform for each application.

New Telephone Patents.

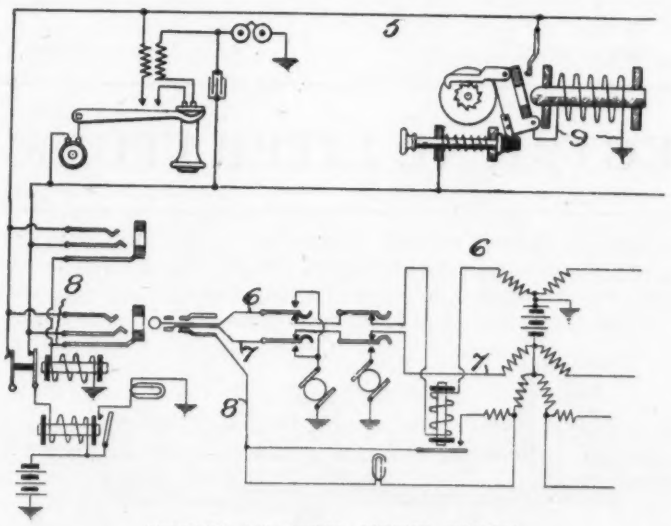
W. W. Dean has patented improvements in his harmonic system to differentiate more decidedly between the different stations. He has found trouble from high-frequency bells cross-ringing with low frequency. In his improved system not only are the bells tuned to different frequencies, but also the generators are wound to higher voltage for higher frequencies, and each ringer has a capacity in series with it graded in inverse relation to the frequency. Thus, the low-voltage of a low-frequency current with the high impedance of a small capacity prevents the high-frequency bells from responding to the low frequency current.

The rudiments of a selective system are contained in a ringer invented by H. M. Bascom, of Brooklyn, N. Y. This ringer has the usual mechanical construction, but one of its coils is on short-circuit, and the armature is biased against the pole of the other coil. Now suppose a current of, say, negative sign assists the bias spring. Then such a current flowing will not effect a motion of the armature, and upon the sudden cessation of it a pole is generated by the short-circuited coil, but this also assists the bias spring. For a positive current, however, upon making the circuit, a positive pole occurs at the second core with a balancing effect. For a cessation of positive current, action begins, as then opposite poles are generated at the core ends.

Besides these various selective systems there has recently been patented a number of step-by-step and lock-out systems ranging from the simplest to the most complex. Three of these systems have been invented respectively by E. Kohn, of New York City; C. A. Bucklin, of New York City, and H. B. Stocks, of Manchester England. These systems all contain the inherent disadvantage of complicated apparatus distributed along the line.

MESSAGE REGISTERING SYSTEM.

A message counter for measured service rates has been invented by C. E. Scribner, the patent being assigned to the Western Electric Company. This is shown in conventional form here-



SCRIBNER MEASURED SERVICE SYSTEM.

with. The counter is located at the subscriber's station and lines equipped with it are to be operated interchangeably with pay upon the depression of the button; the plunger locks and the motion of the counter armature ceases, however, before a count is made. The operator may at will complete the count and release the button, or release alone without counting. This is accomplished by application of earthed current to one or both sides of the line. The one circuit is broken at the counter as soon as the button is released, being completed through the latch. The other circuit is closed through an auxiliary contact just before the release of the button occurs.

AUTOMATIC SYSTEM.

A. M. Bullard, of New York City, has patented an automatic exchange switching apparatus and system adapted to a rather small group of subscribers. The invention lies in the disposition and action of the parts and circuits rather than in any new method of operation. Mr. Bullard's patent is assigned to the Western Electric Company.

J. L. McQuarrie has obtained a patent for a method of mounting and assembling the actuating parts of an automatic switch and has also assigned his patent to the Western Electric Company.

SUB-STATION IMPROVEMENTS.

For some time past the various companies have been adopting switchhooks with removable prong lever. This has the advantage of overcoming a tendency to damage in transit. Several styles have been brought out. One of the latest is that covered by a patent granted to H. L. Knight, of Chicago, and assigned to the Williams-Abbott Electric Company, of Cleveland. In order to overcome difficulties arising from moisture in transmitters, E. C. Brewer, of St. Louis, has produced an auxiliary diaphragm of celluloid which has a rubber cushion ring at its periphery and is thus adapted to seal the metal diaphragm from direct action of the breath, the auxiliary being clamped in front of the main diaphragm.

Letters to the Editors.

Air-Pressure Distribution.

To the Editors of Electrical World:

Sirs:—Referring to your editorial on my article on wind pressures on cylindrical conductors in the issue of September 29th, it is true as you remark that a point-by-point measurement is rather a long method of arriving at results. Nevertheless it is the only method which gives the true picture of the pressure distribution and hence furnishes a correct basis for reasoning.

Air-pressure distribution, particularly on curved surfaces, is a very complex quantity, and so far as I am aware, no theory has been advanced which will cover the actual effects. The pressure at any point may be regarded as composed of the pressure due to the direct stream of air flowing normal to the surface in question, and the reflected air streams from other parts of the surface near by. The theories so far advanced on this subject may be regarded in certain cases as more useful in furnishing a basis of calculation than in representing scientifically the true results.

To one familiar with the difficulties attending measurements of this sort, the methods pursued by Drs. Finzi and Soldati and particularly the details, are worthy of special study. The theory commonly held, that the pressure on a flat surface normal to the flow of a fluid is due to twice the velocity head of the fluid, is based on the fact that a jet impinging on a normal surface and being reflected along the same exerts a reaction equal to twice the velocity head pressure, times the area of the jet, and takes no account of back pressure. This, however, is true only when the jet is much smaller than the surface on which it impinges. Even here the results of the experiments referred to indicate that at no point on the surface is the actual pressure greater than the pressure of the velocity heads, and hence the reaction is due to an increased area. When the whole surface is immersed in a stream, we have both a positive front and a negative back pressure, neither of which is quite as great in all as that due to the velocity head, though it may approach that limit.

You state that you would not hesitate to accept as conclusive measurements by Pitot tubes, and as such measurements are usually made, I agree with you. If the tube faces the flow of fluid, the results should be reliable; but when it makes an angle with the flow, it requires considerable caution in interpreting them. To illustrate, if I recall correctly in the article referred to, when a Pitot tube was held with its axis normal to the flow of air, the velocity head recorded was about equal to the negative velocity head of the air; but by placing a small disc over the opening and perpendicular thereto when the diameter was increased to a certain ratio to the whole diameter, the reading of pressure was independent of the velocity head. Finzi and Soldati made the holes in their surfaces very small and

further proved by the use of porous plugs that the holes had no effect on the pressure. It is my opinion that the method they adopted gave results which could be relied upon.

In conclusion, I wish to state that the Pitot tube, as commonly used, is reliable as a primary source of measurement when directly opposed to the flow of the fluid, but it may also be made reliable as a primary source of point pressure measurement when the opening is normal to the surface and is so small as not to cause appreciable disturbance in the air flowing past it.

San Francisco, Cal. Aug. J. Bowie, Jr.

Polyphase Magnets.

To the Editors of Electrical World:

Sirs:—Returning from a trip abroad I find before me Mr. Lindquist's article on polyphase magnets, in your issue of July 21st. In this article I find a paragraph which hardly states correctly the case under consideration, and although probably no harm is done to the experienced designer of alternating-current magnets, it might lead the mind of the younger engineer into wrong channels, inasmuch as the literature on alternating-current magnet design is scarce and, therefore, he most likely would refer to Mr. Lindquist's otherwise very comprehensive paper. To quote Mr. Lindquist:

"The increased losses are due partly to induced currents in the surrounding brass parts and to increased eddy currents in the laminated iron yoke and core, caused by stray fluxes. Brass would, therefore, appear to be a poor material to use for clamping the laminations. As a matter of experience, however, where the brass is properly applied, it acts as a shield, preventing the straying of the magnetic flux. In other words, the brass shield forces the magnet flux to follow the proper direction, thus actually increasing the pull with a slight increase of current."

Mr. Lindquist states correctly that the increased losses are due partly to induced currents in the surrounding brass parts. These surrounding brass parts form a short-circuited secondary of the magnet, which is nothing else than a transformer. As these brass parts have no self-induction, the induced currents are non-inductive and therefore mean a direct loss in watts. In order to compensate these losses the primary current has to be increased and this increase of the primary current is entirely non-inductive.

Mr. Lindquist further states that as a matter of experience the brass acts as a shield. It is, however, a well known phenomenon that the primary flux of the magnet coil is not altered at all if a secondary winding is brought into the field of the primary coil. In our case the secondary winding is represented by the brass parts. The only thing that happens, is an induced current in the secondary, proportional to that part of the primary flux which it encloses, and a secondary stray field which is interlinked with the secondary circuit. Mr. Lindquist's experience seems therefore to be due to some other effect which he did not take into consideration. In order to compensate the field of the secondary winding, the primary current has to increase so as to keep the resultant field, which depends only upon the terminal voltage, constant.

It is therefore clear that it is better to increase the flux, not by such artificial means, as Mr. Lindquist proposes, if that were possible at all, but by simply increasing the primary current through a decrease of the primary turns. This way has the advantage that the increased current is mainly an *inductive* current and does not materially increase the total watt losses of the magnet. If the primary turns are decreased, of course the induction in the iron is increased and a greater loss results from this increase of the induction. But this additional loss certainly is not as great as Mr. Lindquist's "slight" increase due to a short-circuited secondary.

Mr. Lindquist seems to have the impression that an increase of the primary flux increases the pull of the magnet, but this is not the case at all. The flux which produces a *useful pull* is the flux resulting from the combined primary and secondary flux. This flux, as stated above, is constant as long as the terminal voltage of the magnet is constant and therefore an increase of the primary flux is of no advantage at all, as long as the resultant flux cannot be increased thereby, and as we have stated, the resultant flux is not increased by the introduction of brass parts which act as a secondary winding. For further details on this very important subject, we would refer to Steinmetz's "Alternating Current Phenomena."

Milwaukee, Wis. Arthur Simon.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Artificial Cooling of Commutators.—A description of a method of artificially cooling the commutator of direct-current machines, and especially of continuous current turbo-generators, in order to reduce the length of the commutator, which would otherwise become unwieldy in size on account of temperature rather than commutation considerations. The construction is used by Siemens Bros. and Toplis, and is shown in Fig. 1. Each commutator bar has a longitudinal passage, *m*, through it, whose cross-section may be of any suitable shape, but is preferably of such shape that the largest area of metal is exposed to the air passing through the passage compatible with the preservation of suitable electrical resistance and mechanical strength of the bar, and suitable low resistance to the passage of the air. For convenience of manufacture, the bars are preferably made up of two sections, put together so that a groove in one registers with a like groove in the other to make up the passage. The construction of the commutator shown is one usual for high-speed commutators. The bars are mounted on the sleeves, *b*, keyed to the shaft, and are insulated from the sleeve by mica rings, *d*. Steel rings, *e*, hold the bars in place on the sleeves, being insulated from the bars by mica rings, *f*. Nuts screwing on the shaft hold the sleeves in position. The two parts of the commutator have an air-gap, *n*, between them, and at this place the end of each bar has sweated to it a copper vane, *h*; these two sets of vanes are united to each by flexible copper strips, *o*. Surrounding the vanes is a casing, *k*, having an opening or openings, *l*, in its periphery, preferably at the top. When the commutator rotates the vanes, *h*, act as a centrifugal fan which draws air through passages in the bars, as indicated by the arrows, thus cooling the commutator. As the heated air is thrown out at the openings, *l*, there is little chance of its circulating through the commutator again until it has cooled. It is obvious

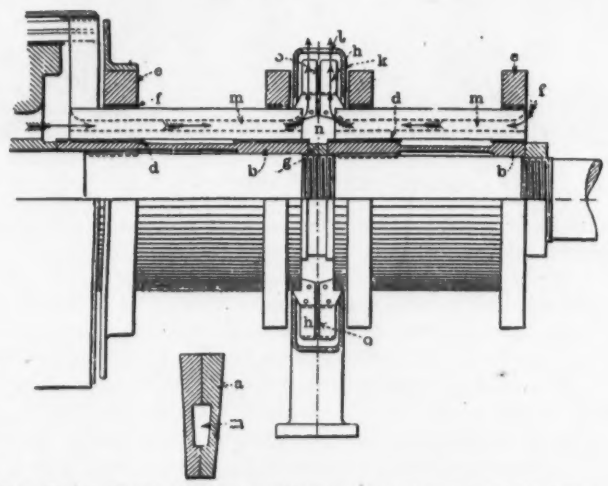


FIG. 1.—SECTION OF COMMUTATOR WITH FORCED VENTILATION.

that, instead of constructing the commutator in two parts, the bars, *a*, may be continuous from end to end of the commutator, and may be perforated to open the passages to the air at the place where the vanes are, which need not be at the middle of the bars, although this is the most suitable place. Instead of

a single passage, *m*, each bar may have two or more passages. Lond. *Elec.*, September 28.

Induction Machines.—Lombardi.—An article referring to the old controversy whether the well-known circular diagram for induction motors may be applied to their operation at speeds above synchronism as induction generators. The author has made practical tests with an 8-kw, three-phase machine and established a fair agreement between Ossanna's diagram with his experimental results, both below and above synchronism. He also used his tests to examine the correctness of the diagram of Grob, which gave very satisfactory agreement. The feature of the experiments resides in the testing of the machine at speeds considerably beyond synchronism, and the chief result of his investigation is that the circular diagram may be applied without hesitation to induction generators.—*Elek. u. Masch.*, September 30.

Inter-poles.—Several communications. Martinet and Breslauer discuss the distribution of the magnetic flux in a machine provided with interpoles. Arnold and Breslauer discuss the best number of interpoles. Arnold corrects slightly some formula given by him on this subject before, while Breslauer denies the correctness of Arnold's argument that copper may be saved if an interpole is not provided between each pair of main poles, but only half the full number of interpoles or less are used. He claims that no saving in material can be expected and that the predetermination of the machine becomes somewhat uncertain because it is difficult to estimate the armature field in those spaces between two main poles in which no interpole is provided. The increased distortion of the field and the dissymetries to be expected may cause less favorable conditions of commutation. However, Breslauer agrees that Arnold has proven theoretically and practically the possibility of omitting some of the interpoles and this may be of importance if for reasons of methodical construction it is impossible to place interpoles at two points.—*Elek. Zeit.*, September 27.

Interpole Direct-Current Machines.—A digest of a number of papers and letters on the theory and practice of direct-current interpole machines, published in German journals. All of these papers have already been noticed in the Digest.—Lond. *Elec.*, September 28.

Interpole Direct-Current Machines.—Liouville.—An illustrated article on their theory and predetermination.—*L'Industrie Elec.*, September 25.

Single-Phase Motors.—Courtot.—An article illustrated by diagrams giving the theory of single-phase non-synchronous motors, with single-phase rotors.—*L'Eclairage Elec.*, September 15.

Three-Wire Dynamos.—Klein.—The first part of an illustrated article in which the author first explains the advantages of the three-wire system and then deals in detail with the construction of a single dynamo with three brushes for supplying a three-wire system. The description is chiefly historical, and is illustrated by diagrams.—*Elek. Anz.*, September 16, 20 and 30.

Lamps and Lighting.

Mercury Arc.—Weintraub.—A Franklin Institute paper on the mercury arc, its properties and technical applications. The author discusses the structure of the mercury arc, the properties of the cathode, different methods of starting the mercury arc, the stability of the mercury arc, arcs in metallic vapors other than mercury, alternating-current phenomena in the mercury arc, and arcing. In speaking of technical applications, the use of the arc as a source of light and as a rectifier are dealt with. —*Jour. Franklin Inst.*, October.

Power.

Load Factor of Water Power Plants.—Perrine.—A Franklin Institute paper in which the author after defining the term "load factor," discusses its importance in generating plants. In steam plants it is difficult with a load factor of 30 per cent to reduce the coal consumption to less than 5 lbs. per kw-hour, even though the steam apparatus at its most economical load will operate on less than 2 lbs. per kw-hour. This matter of load factor often affects a hydro-electric plant more seriously than a steam plant, although it is more generally true that the adaptation of the plant to the load factor is more often controllable in the design of a hydro-electric plant than in the design of the steam plant. The exceptional case of a unity factor is found in certain of the Niagara plants and nowhere else; there the water flow is constant and the load is that of the electrochemical industries whose load is closely controllable. Where the load factor is less than unity and sufficient storage may be provided, no waste of energy occurs. Certain plants may be designed where the head and storage are simultaneously obtainable, and it is often advisable to sacrifice other elements of design to solve the problem in this manner. For example, the simplicity of the plant obtained by the use of a high head has in certain plants already built caused an oversight of the fact that a construction more closely adapted to the condition of loading might have been obtained by changing the location to one of lower head but more than equivalent storage and at a lower cost in proportion to the service to be rendered. Storage sufficient to take care of a load factor of less than 60 per cent is rarely obtainable in larger plants where the head is less than about 100 ft. for the reason that the quantity of water necessary to store becomes too great to be provided in the available storage basins. A correlative solution of this problem of design is found in the selection of the load itself. Often the complete solution of the economical problem involves the use of steam or gas auxiliaries, and this does not represent any weakness of the hydro-electric system. It is not reasonable to develop a hydro-electric station, when a steam or gas station could be built which would supply the same territory at a less cost, but it is also unwise to condemn a hydro-electric development because the cost per unit of capacity is high, when at the same time it can develop power more cheaply than can be done in any other manner.—*Jour. Franklin Inst.*, October.

Swiss Water Power Plant.—Solier.—An illustrated description of the electric installations of the city of Saint Gall, of Switzerland, which are especially interesting on account of their gradual development from very small beginnings. Older gas engine stations have been retained and are used now as reserve, while the chief power is at present obtained from the river Goldach, the hydraulic power of which varies between 500 and 100 hp. There are two turbines, each of 200 hp, and driving a 3,600-volt, three-phase generator. The station in Saint Gall, which is quite heterogeneous in its equipment, is also described in detail.—*L'Eclairage Elec.*, September 15.

Superheated Steam.—Mann.—An article discussing the advantages of superheated steam in the power station, and stating that the difficulties met in the handling of the superheated steam are not severe, and that the additional expense over and above that in a saturated steam plant is trivial.—*Jour. Franklin Inst.*, October.

Traction.

Municipal Traction in England and Motor-Omnibuses.—Hamilton.—At the fifth annual convention of the (British) Municipal Tramway Association, Hamilton in his presidential address gave the following statistical data on municipal tramways in England. For the last year the Board of Trade returns show that, roughly, $165,000,000 had been expended by local authorities in tramway undertakings (meaning evidently plants owned by municipalities, whether operated by them or not). This shows an increase of about $25,000,000 for the year. The number of miles open is 1,395, and the number of undertakings is 174. Of this number 115 are municipally operated, the capital expenditure being about $142,500,000. The gross receipts for the whole of the municipally-operated undertakings is about $30,000,000, while the number of passengers carried at about 2 cents per head is 1,355,000,000 an increase for the year of 160,500,000. Combining municipally owned and operated tramways and company tramways, there is a total capital outlay of $264,000,000, the miles of lines in operation are 2,116, the total gross receipts amount to $50,000,000, and the passengers carried reach the huge total of 2,068,000,000. In speaking of motor omnibuses the author claimed that the petrol omnibus is yet far from a sure and reliable conveyance. In London the most fortunate companies have a maximum of about 70 per cent of their total stock on the road at any time while many of them have only between 50 and 60 per cent. "Apart from the traffic-destroying vagaries of the omnibus, there is the cost of running to be considered. On the most level and easily-worked routes, when thorough normal maintenance is carried out and sufficient depreciation allowed, the expenses per 'bus mile are but little under 25 cents. It is

almost impossible to compare these results with that of an electric tramway, which costs, including sinking fund, depreciation and renewals, practically about 15 cents per mile to run, because in addition to the saving per mile run, there is the much greater attraction for traffic owing to being more reliable, the greater carrying power of each vehicle—56 as against 36 or 38—and the fact that an immense saving occurs in other departments of the Corporation as a result of the maintenance of a large proportion of the highway in the principal streets by the tramways department."—Lond. *Elec.*, September 21.

Car Brakes.—Mozley.—A paper read before the (British) Municipal Tramways Association. The author's conclusions are as follows: "Bogie cars are easier to control on steep inclines than four-wheel cars, whatever the character of the brakes. Magnetic brakes, particularly those which affect the wheel brakes, are unsuitable for tramways either for service or safety purposes. That they can only be considered as auxiliary to the rheostatic brake, and not as independent track brakes. That they are highly destructive to the motors. They are treacherous and uncertain in their action. The only form of brakes which will safely control a car on gradients greater than 1 in 14 or 15 are: (a) Hand brake with adequate leverage actuating cast-iron blocks on the wheels; (b) mechanical track brake with adequate leverage provided with cast-iron slippers; (c) rheostatic brake for emergencies only." In the discussion which followed Mr. Fell criticised several points of the paper and claimed that the author had not considered the progress made in magnetic brakes during the last three years. There were also other criticisms. —Lond. *Elec.*, September 21.

Tramway Brakes.—Sayers.—The first part of a discussion of different types of brakes in use at present on tramway cars.—Lond. *Elec.*, September 28.

Simplon Tunnel.—An illustrated description of the electric locomotives used in the Simplon tunnel, which have been noticed repeatedly in the Digest.—Lond. *Elec.*, September 28.

Installations, Systems and Appliances.

Oscillations in Direct-Current Circuits.—Feldmann and Herzog.—It has long been known that if the conditions in an alternating-current network are suddenly changed, oscillations of high frequency are produced which may cause dangerous increases of voltage. The present authors show that such dangerous over-voltages, with frequencies between 15,000 and 20,000 periods per second, which may cause the breakdown of underground cables, may also occur in direct-current, 500-volt cables with sudden changes of electrical conditions. The reason is that the self-induction of the cables, which has generally been neglected up to the present, forms, in this case with the capacity, a more or less damped oscillation circuit. The paper is to be concluded.—*Elek. Zeit.*, September 27.

Wires, Wiring and Conduits.

Twin Lead-Covered Wire.—Berry.—A paper read before the London Section of the British Electrical Contractors' Association, on a new method of employing vulcanized rubber twin lead-

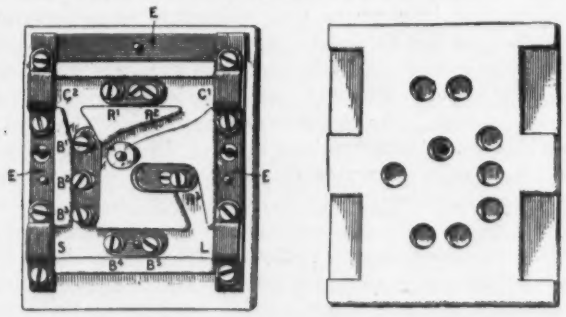


FIG. 2.—BASE AND COVER OF JOINT BOX.

covered wires for electric light wiring. The author thinks that while this type of wire is ideal, it has not been used as much as deserved on account of lack of a satisfactory joint. He describes a porcelain joint box, which is illustrated in Fig. 2. It consists of two blocks of porcelain, the base and the cover; on three sides of the rebated edge of the base is an "earth plate," E, to which are screwed, opposite the points at which the wires enter, four saddles, C^1, C^2, S and L, by means of which the lead sheathing of the twin wire is securely clamped to the earth plate, thus insuring metallic continuity of the lead sheathing of the four lengths of wire which enter the box. In the center of the base, and entirely imbedded in porcelain when the cover is in position, are four contact plates fitted with the requisite number of pillar terminals for connecting the four pairs of wires, marked R^1, R^2 B^1, B^2, B^3, R^3 and B^4, B^5. Two of these contact plates, R^1, R^2 and R^3, are permanently connected together in a recess at the back of the base. The wires are connected in the following manner: A pair of 3/20 circuit wires from the distributing board enters the box at C^2, the red wire being connected at R^2, the black wire at B^1. On the opposite side of the box at C^1 is connected another pair of 3/20 wires, the red wire at R^3, the black wire at B^3, and is carried on from box to box up to the full number of wire points which it is arranged to connect to this one circuit. A pair of 3/22 wires is run from the ceiling rose or light point and enters the box at L, the red wire being connected at R^3, the black wire at B^5. A pair of 3/22 wires is run from the switch point and enters the box at the opposite side, S, the red being connected at B^4, the black at B^5. Thus it will be seen that a joint box is required for each wire joint. In the case of a wall socket not controlled by a switch the pair of wires from the wall socket point enters the box at L, the red wire being connected at R^3, the black wire at B^5, and the terminals, B^3 and B^4, are connected by means of bare copper wire. In the case of a wall socket controlled by a switch, the pair of switch wires would enter the box at S, and be connected to the terminals, B^3 and B^4, instead of the bare copper wire as previously described. Every length of wire where it enters the joint box has its lead sheathing clamped to a plate which is common to all the wires entering the box. It only remains, therefore at each distribution board to connect the circuit wires by means of a metal strip fitted with the same number of saddles as are fitted to the earth plate of the joint boxes, the said metal strip being connected to the lead sheathing of the mains where they enter the distribution board with a metal clip and copper wire, so as to ensure the whole of the lead sheathing of all the wires of the installation being metallically continuous throughout. The lead sheathing of the mains at the supply end is connected to a water pipe by means of clips and copper wire. In the discussion several speakers doubted the claimed advantages of the new system, though they seemed to agree that the method was specially intended for cottage work.—Lond. *Elec.*, September 28.

Electro-Physics and Magnetism.

Eddy-Currents in Sheet Iron.—Kuehns.—Steinmetz's formula for the eddy-current loss in watts per cubic centimeter of iron is $\xi\, p^2\, \beta^2 \times 10^{-7}$, where ξ is the eddy-current coefficient, p the frequency and β the maximum magnetive flux in the iron. The present author has investigated the eddy-currents in iron sheets of different thickness, the thickness varying from 0.3 to 1.2 millimeters. The tests were made with a wattmetric method, using the apparatus of Epstein. Both rolled "ordinary" dynamo sheet iron and rolled "iron-alloy sheets" made by Capito & Klein, were tested, the specific resistance being 0.13 and 0.50 respectively. It was found that the increase of the Steinmetz eddy-current coefficient is proportional to the thickness of the sheets, and that the coefficient itself is inversely proportional to the specific resistance of the iron. An increase in the specific resistance of the "iron-alloy sheets" is accompanied by a diminution of the eddy-current losses, which is quite considerable.—*Elek. Zeit.*, September 27.

Electro-Chemistry and Batteries.

Electrical Discharges Through Air.—Cramp and Leetham.—The authors found that a much better bleaching agent for flour than ozone alone is air that has first been ozonized and then passed through boxes in which electrical discharges between spark points are taking place. The construction of the commercial apparatus is described in detail and an account is given of a long series of experiments on the different forms of electrical discharges and their effects, of the influence of the frequency, air velocity, distance apart and shape of discharge points, etc. After a discussion of the electrochemical and chemical side of the problem, they conclude that in order to obtain good yields of oxides of nitrogen from the air, it is not essential that a very

high temperature should be used. Very thin electric discharges existing between many pairs of points (the latter being as far apart as insulation will allow and supplied by alternating current of high frequency) will give, probably, the most economical results. By this means long flames of burning nitrogen may be produced which do not appear to have a temperature approaching that of the arc, but yield, nevertheless, as much oxides of nitrogen with a smaller expenditure of power. Good results are to be looked for, not by increasing the current supplying those points so much as by increasing the number of pairs of points used. The use of a current of air to extend these discharges is to be advocated, but the limits of the velocity of this air current is determined by the oscillations set up in the circuit thereby; for above a certain point no commercial insulator will stand the effect of these latter. The points used should be conical in shape, of such proportions that they do not readily burn away. Steel is, perhaps, the best material. In order to obtain good yields of ozone electric discharges should be allowed to take place between edges or points, these discharges being controlled by a high steadying resistance or impedance, so that they cannot possibly develop into that form of discharge which is so concentrated that it may be blown into a flame. An alternating-current of high frequency should be used, and to avoid the production of oxides of nitrogen, the air supplied should be dry, clean and cold, and every precaution should be taken to keep the whole apparatus cool, as, with high temperature, ozone is immediately split up.—*Electrochem. and Met. Ind.*, October.

Units, Measurements and Instruments

Platinum Resistance Thermometers.—A note on the use of platinum resistance thermometers for calorimetric tests. The platinum wire must not itself become too hot, and should therefore have a high cooling constant, which is also required for other considerations. The following notes relate to the work done by Jaeger and Steinwehr of the German Reichsanstalt. The Callendar form of platinum spiral having proven unsuitable on account of its low cooling constant, a platinum wire, 0.1 millimeter in diameter, was, in the first experiments, placed within a finely drawn glass tube, 1.5 millimeter in diameter, and bent to a horseshoe; high insulation of the platinum wire is, of course, necessary. The device was too brittle, however, and there was trouble with the connections. In the improved form the platinum wire is painted with shellac, and then covered with silk thread. The silk windings need not be very close to one another, as they are only to prevent contact between the wire and the brass tube, 1 millimeter in diameter, which serves as its sheath. The ends of the platinum wire are soldered each to a pair of copper wires, which are taken to four binding screws fixed in a square frame. These copper terminals are partly encased in wide brass tubes soldered to the long tube, which is bent to a long horseshoe. A current of 0.01 ampere heated this wire, which has a length of 35 centimeters, and a resistance of 8 ohms, by 0.002° C. The heating is almost instantaneous, and might be disregarded, as it is eliminated in the course of the calculation. But it is advisable to be cautious in this respect. The wire cooled through half its temperature increase within 0.02 second, while with mercury thermometers and other platinum thermometers this cooling took from 5 to 10 seconds. To take readings of 0.0001° C., requires a change of the wire resistance by about one five hundred thousandth of its amount. The resistance measurements are made by the Kohlrausch method of overlapping shunts. When the difference between the temperatures of the calorimeter and of the air outside amounted to 1° C., the temperature of the calorimeter changed by about 0.0015° C. every minute.—Lond. *Eng'ing*, September 14.

Spherical Photometer.—Presser.—The conclusion of his illustrated article on the theory of the Ulbricht spherical photometer which has been mentioned repeatedly in the Digest. In the present installment the author shows that it is preferable in practice to use only part of a sphere when the object is to measure the mean hemispherical cp. The author concludes by briefly reviewing the sources of error which may arise with this instrument.—*Elek. Anz.*, September 9.

Battery for Electrostatic Measurements.—Herweg.—A description of a cheap high-tension battery for electrostatic measurements. It is a water battery completely enclosed in paraffine, and it has therefore the advantage that it may be used in any position. A number of holes are made in a block of paraffine and strips of zinc and copper are welded together and bent into U form, and are then inserted in such a way into the holes of the paraffine that the zinc leg is in one hole and the copper leg in the next hole, and so on. All the holes are then filled with distilled water and fused paraffine is poured above the whole surface.—*Phys. Zeit.*, Oct. 1.

Potentiometer.—Brooks.—A long illustrated description of a new deflection potentiometer for the measurement of electromotive force and current. The underlying idea is to use the potentiometer method for measuring the bulk of the electric quantity, in conjunction with a suitable deflection instrument to measure the small remainder, which may be of the order of 1 per cent of the total. For example, if the e.m.f. is between 110 and 111 volts, the potentiometer method may be used to measure the 110, the decimal part being read by deflection. The theory of the method is given in detail, and an instrument of this type constructed for the Bureau of Standards is described.—*Bull. Bur. of Standards*, Vol. 2, No. 2, August.

Self-Inductance and Frequency.—Coffin.—In the construction of an absolute standard of self-inductance for the Bureau of Standards, it was found by calculation that a diminution of as much as 0.3 per cent in the self-inductance of the coil could take place as the frequency increased from zero to infinity. This change, which in coils of small radius may be larger than this, must certainly be allowed for in accurate measurements, the precision of which in certain cases may reach as high as 1 in 100,000. The author gives a complete theory of the influence of frequency upon the self-inductance of cylindrical coils of m layers. These formulas are valid for the change in self-inductance of any number of layers and for all frequencies.—*Phys. Rev.*, September.

Secohmmeter.—Milner.—Ayrton and Perry's secohmmeter is an instrument which consists essentially of two rotary commutators mounted on the same axle, by the rotation of which rapid reversals of the battery and galvanometer terminals of a Wheatstone bridge system may be produced. It was originally designed for comparison of inductances, but the author shows in detail how to use it also for the measurement of combined resistances and capacities.—*Phil. Mag.*, October.

Telegraphy, Telephone and Signals.

Microphone.—In the ordinary microphone the loose contacts are provided behind the diaphragm so that an increase and decrease of the pressure only in the direction behind the diaphragm is effective. Since the diaphragm vibrates in both directions, an increased effect may be produced if loose contacts both in front of and behind the diaphragm are provided. Trials in this direction have been unsuccessful in the past since experimenters did not succeed in producing equality of the changes of resistance for the vibrations of the diaphragm in both directions. A microphone in which the requirements are said to be fulfilled has recently been devised by the Zurich Telephone Co., which is illustrated in Figs. 3, 4 and 5; *a* is the diaphragm. In front of the same a metallic plate, *g*, is provided with a hole in the center. On its interior surface it is provided with a ring, *d*, of carbon, with little holes, *f*, on the side toward the diaphragm.

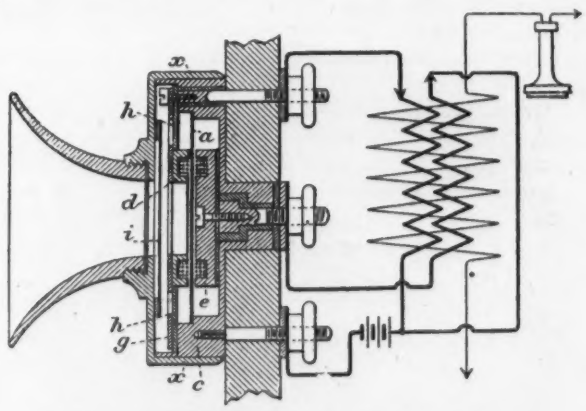
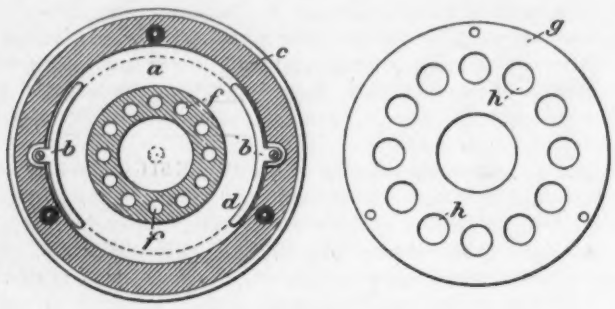


FIG. 3.—SECTIONAL VIEW OF MICROPHONE.

These holes are filled with small carbon particles. On the other side of the diaphragm a carbon disc, *e*, is provided, with corresponding holes, also filled with carbon particles. If the apparatus is adjusted so that the diaphragm is vertical, the carbon particles form loose contacts on both sides of the diaphragm, in the same way as in other microphones. The electrical connec-



FIGS. 4 AND 5.—DETAILS OF MICROPHONE.

tions are such that the current passes from the battery to the diaphragm, and is divided here into two branches. One branch current passes through the carbon particles in front of the diaphragm to the carbon ring. The other branch current passes through the carbon particles behind the diaphragm to the carbon disc. The induction coil has two primary windings, each forming a branch circuit. The turns of both coils are wound in the same direction around the core, but they are connected to opposite poles of the battery so that their inductive effect is opposite. Since the ring, *d*, has a hole in the center, the sound waves act on the middle part of the diaphragm and produce vibrations which propagate in concentric circuits. These vibrations act on all contacts on one side of the diaphragm in the same direction, and in the same strength, while the action on the contacts on one side of the diaphragm is opposite to the action of the contacts on the other side. An increase of the pressure and therefore a diminution of the resistance on one side of the diaphragm therefore corresponds to a diminution of the pressure and an increase of the resistance on the other side. "The resulting changes of current must be equally large in the contacts in front of the diaphragm as in the contacts behind the same, since after a vibration in one direction the diaphragm must swing back to the other side by the same amount, in order to return to its condition of equilibrium." The disc, *i*, of lacquered linen, or similar material, prevents moisture from the mouth from reaching and destroying the contacts. Some calculations are given to show that the construction has distinct advantages, and it is said that these results are confirmed by experiments. The construction permits an increase in the number of contacts within rather wide limits, and therefore the use of a larger battery than is possible with other microphones.—*Elek. Anz.*, September 13; *L'Industrie Elec.*, September 25.

Wireless Telegraph for Railroads.—Nesper.—An article on experiments made on German railroads on using wireless telegraphy for safety signals. Transmitting stations are provided on the different railroad stations, while the receiving station is on the train. The experiments showed that quite satisfactory results may be obtained even with unskilled attendants.—*Elek. Zeit.*, September 27.

Miscellaneous.

Supply of Copper.—Buerner.—A lecture held at the annual meeting of the Society for the Mutual Protection of the Commercial Interests of German Electrical Manufacturers. The author first refers to the continuous increase in the price of copper during the last year and a half, and points out the part of the United States in the production of copper. In 1882 the world's production of copper was 181,622 tons, of which 40,470 tons, or 22 per cent, were produced in the United States. In 1900 the world's production was 479,514 tons, of which 263,502 tons, or 55 per cent, were produced by the United States. In 1905 the world's production was 672,845 tons, of which 379,545 tons, or 57 per cent, were produced in the United States. Electrical manufacturers are especially interested in the price of copper since the copper needed by them must fulfill certain requirements so that they can use "only a certain quantity from a certain country. We all know that this is the electrolytic copper of the United States." The enormous advance of the copper refineries in the United States in recent years is pointed out, and certain remarks are made concerning the amalgamation of companies. With respect to the conditions in Germany, it is said that the consumption of copper in Germany has increased in the last 15 years from 52,000 tons to 127,000 tons, that is by 145 per cent, while the German production has increased from 24,000 tons in 1891 to 31,000 tons last year, that is only 38 per cent. This involves, of course, greater importations of copper to Germany.—*Elek. Anz.*, September 23 and 30.

BOOK REVIEW.

Populäre Schriften. By Dr. Ludwig Boltzmann. Leipzig: Johann Ambrosius Barth. 405 pages, 9 illustrations.

This collection of popularly-written papers by Dr. Boltzmann, the great Viennese mathematical physicist, touches a variety of subjects of permanent interest. Some refer to the dynamical theory of heat, the kinetic theory of gases, and the fundamentals of rational mechanics, while there are others on Schopenhauer, Kirchoff, Stefan and Loschmidt. In every one the master's mind and master's hand are apparent; definite views are expressed throughout with ease, grace and precision. A translation of such a volume would serve a useful purpose and would form an appropriate sequel to the similar popular addresses of Helmholtz and Lord Kelvin.

It is but a few months since these pages appeared and already the gifted author has passed away from the busy scenes of life. Born in Vienna on February 20, 1844, Boltzmann studied successively in Vienna, Heidelberg and Berlin. His fondness for change and travel accompanied him through life, as is seen by the University positions which he held at Graz, Munich, Leipzig and Vienna. Boltzmann was a great worker, even if fond of change of scenery and surroundings; he had a vigorous and active mind and wielded a severe pen at times, though a man of kindly disposition.

To him, in collaboration with Stefan, we owe the law that the energy of radiation emitted by a lamp-black body is proportional to the fourth power of the absolute temperature; to him also we are partly indebted for the important Boltzmann-Maxwell law of diffusion in the kinetic theory of gases.

Boltzmann criticised Ostwald's views on energetics unsparingly, but was in sympathy with Van't Hoff's hypothesis of osmotic pressure.

The last paper in this volume of Populäre Scriften is entitled "Trip of a German Professor to El Dorado," and contains an interesting and freely-written account of the author's last visit to this country during which he spent some time out in California. In the limit of thirty-three pages he gives his impressions of persons and things and he does so with a vein of humor that adds a charm to the narrative.

Dr. Ludwig Boltzmann was in his 63d year when, in a moment of unaccountable weakness, he put an end to his life on Wednesday, September 5.

Electrical Mine Pumps at the Ward Shaft.

By Leon M. Hall.

The pumping plant just received at the Ward shaft, Virginia City, Nev., is probably the largest and most complete electrically-driven mine pumping installation ever constructed, so that a brief description of the same, together with the reasons for its existence, may be of interest to those engaged in the mining and electrical industry.

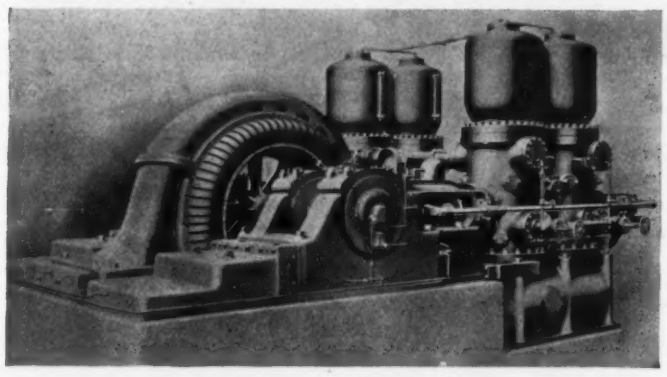
The Ward Shaft Association was formed some three years ago for the purpose of opening the Ward shaft and of draining the middle group of mines on the Comstock, in order to explore this lode to its very lowest depths. This shaft was originally sunk to a vertical depth of 2,480 ft., and just before reaching this point it passed through a vein which proved to be a mineralized

fissure over 60 ft. in width. Some fifteen years ago the shaft was abandoned on account of the stagnation then existing in the silver market and, with the cessation of work, it was allowed to decay and partially fill with rock and refuse of all kinds.

The shaft was rehabilitated and retimbered recently without much trouble to the 1,600-ft. level, at which point a drainage drift was run 275 ft. to connect with the south lateral branch of the Sutro tunnel. In reopening the shaft a considerable flow of very hot water was encountered so that quite an extensive temporary pumping plant was necessary and this will be briefly described in the following:

On the 2,100-ft. level a 6¾-in. by 8-in. Knowles vertical triplex pump, geared to a 100-hp squirrel-cage induction motor, was placed and arranged to take its water from a three-step Byron Jackson centrifugal pump belted to a 50-hp induction motor, located on the 2,330-ft. level. In turn this centrifugal pump receives its supply from a 9-in. Blake sinking pump at the bottom of the shaft. Two Ingersoll-Sergeant compound air compressors driven by two 100-hp motors are in operation on the surface and supply this sinker with the necessary motive power. This temporary plant is raising 300 gal. of water per minute 855 ft., from the present sump to the Sutro tunnel level.

In order to supplement this plant a five-step Byron Jackson centrifugal pump, directly connected to a special induction motor, has been installed on the 2,410-ft. level. This pump has a capacity of 600 gal. per minute against a head of 900 ft., and it will take its supply of water directly from the sinking pump, thereby doing away with the triplex and centrifugal pumps before mentioned.



ELECTRICALLY-DRIVEN MINE PUMP.

This pump is entirely of bronze, operates at 1,700 r.p.m., and under these conditions shows an efficiency of 67 per cent with the water temperature at 160° F. This pump will be duplicated immediately for safety of operation, and, with these as an auxiliary, the company confidently hopes to reach the 3,100-ft. level at no distant day.

On the 3,100-ft. level the excavation of a pump station 80 ft. long, 24 ft. wide and 20 ft. high is contemplated, in which will be placed the permanent pumping plant, the real object of this sketch.

The capacity of this permanent installation will be 3,200 United States gallons per minute against a total head of 1,550 ft., and this will be divided between two units each separately driven by a special slow-speed, 800-hp induction motor. The pumps are of the Knowles express type and are the embodiment of all of the best mechanical and electrical ideas obtainable for this class of work. They are outside end-packed duplex double-acting pumps with plungers 6 11/16 in. in diameter and 15 in. stroke. The rotating element of the motor is placed directly on the crank shaft, and will operate at 195 r.p.m.

The valves are automatic poppet valves arranged in nests of 13 each. The valve area (103.35 sq. in.) is unusually large, so that the consequent movement of the valves is extremely small, all of which is conducive to a high rotative speed with a minimum of wear.

The plant will be equipped with a three-stage electrically-driven air compressor for charging the air receivers, a vacuum pump and an automatic oiling system. For convenience of erection and repair, the pump station will be fitted with a 15-ton traveling crane; in fact, it is intended to include in this plant everything that will insure reliability and ease of operation. The total cost of the equipment complete for operation will be about $125,000.

The electric current is taken down the shaft at 2,240 volts over a three-conductor lead-covered steel-armored cable of 400,000 circular mils capacity. The electric motor equipment throughout has been supplied by the Westinghouse Electric & Manufacturing Company, which also furnished the electric plant of the Truckee River General Electric Company from which the electrical energy for operation is obtained.

Portable and Switchboard Instruments.

Fig. 1 herewith shows a combination volt and ammeter built by the Robert Instrument Company, Detroit, Mich. The instrument is of the watch size type with a clearly drawn and

FIG. 1.—COMBINATION VOLT-AMMETER.

equally divided scale. It is, of course, intended for battery use and is very convenient for this purpose. The amperes are indicated on the upper scale and the volts on the lower scale; but both are not indicated simultaneously. Two pegs are

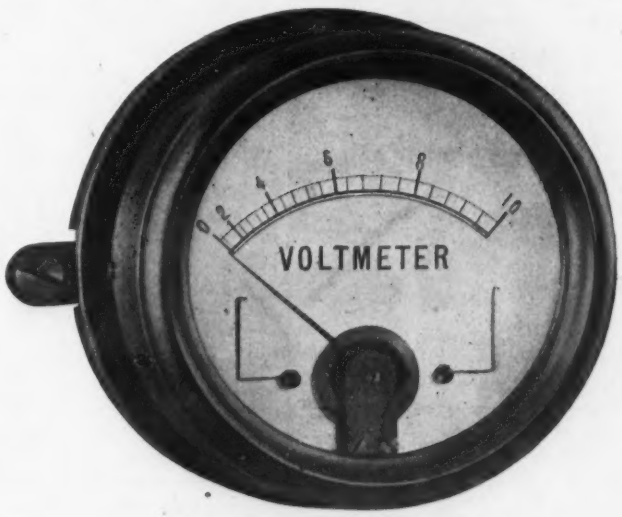


FIG. 2.—SWITCHBOARD VOLTMETER.

provided at the bottom of the instrument which serve as the positive contacts for the voltmeter and ammeter respectively; the negative contact is common to both and is connected to

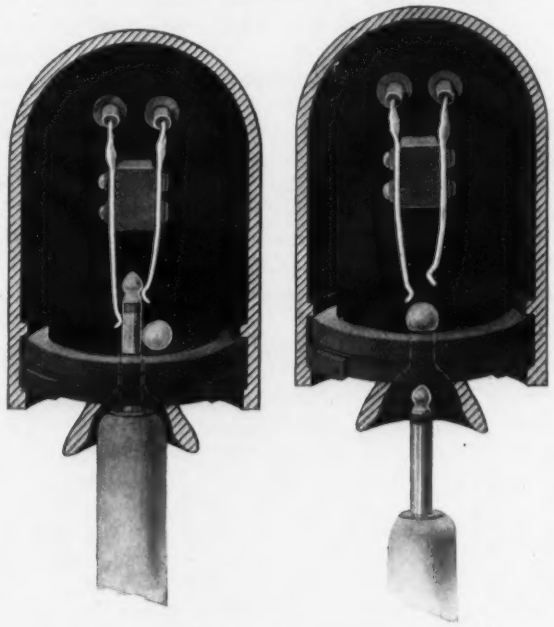
the instrument through a flexible cord. The instrument is claimed to be accurate and dead beat, and is provided with a leather case. The company also builds a line of pocket ammeters and voltmeters similar in size and design to the combination instrument shown in Fig. 1. Fig. 2 shows a voltmeter intended for switchboard use. These instruments are built in two sizes with base diameters of 2½ and 3¾ ins., respectively. Ammeters of similar size and design also form part of the line of switchboard instruments. Both the voltmeters and ammeters of the smaller size are built for three different scale readings. The ammeter of the larger size is built for four scale readings and the voltmeter shown in Fig. 2 is built for scale deflections ranging from 0-6 to 0-250 volts. The latter instruments being intended for continuous service differ in construction from the instruments intended only for intermittent use. In finish and appearance the instruments conform to the usual switchboard requirements.

The Lima Telephone Jack Box.

Fig. 1 herewith shows the application of the Lima jack box by means of which a train crew is enabled to obtain instant connection with the dispatcher without the delay of unlocking and locking a booth and without leaving the car. Fig. 2 shows the parts of the device grouped in the order in which they are assembled from which may be noticed the manner in which the spring jack holder is insulated from the outside casing. The spring jacks are made of extra heavy material and are mounted on a fibre block. The connections pass through mica bushings and are soldered to the weather-proof wire on the back of the spring jack holder. The plugs have long handles and are so constructed as to leave no metal parts exposed in the jack box. The plug is equipped with a fuse as a protection against heavy currents. The lock washer shown at the bottom of Fig. 2 securely holds the spring jack holder in the casing and cannot be removed without special tools. This prevents irresponsible persons from tampering with the inside of the box. Figs. 3 and 4 show cross-sections of the box, the former showing the plug engaged and ready for conversation, and the latter showing the plug being withdrawn and the manner in which the ball drops back and closes the opening against the entrance of dust, moisture and insects. A cone-shaped mouth serves to guide the plug, and in conjunction with the outer cast-iron shell of the receptacle forms a double petticoat to shed rain, sleet and snow. The device is used on the lines of the Ft. Wayne, Van Wert & Lima Railway Company, one being installed every half mile. It is also in use on the lines of the Muncie & Portland Traction Company. The patents and rights of manufacture for the box and plug are owned by W. N. Matthews & Bro., 227 North Second Street, St. Louis, Mo. A working exhibit was maintained in Space 18, section B, building 6, at the Street Railway Convention at Columbus, Ohio, October 15 to 19.

FIG. 1.—JACK BOX IN USE.

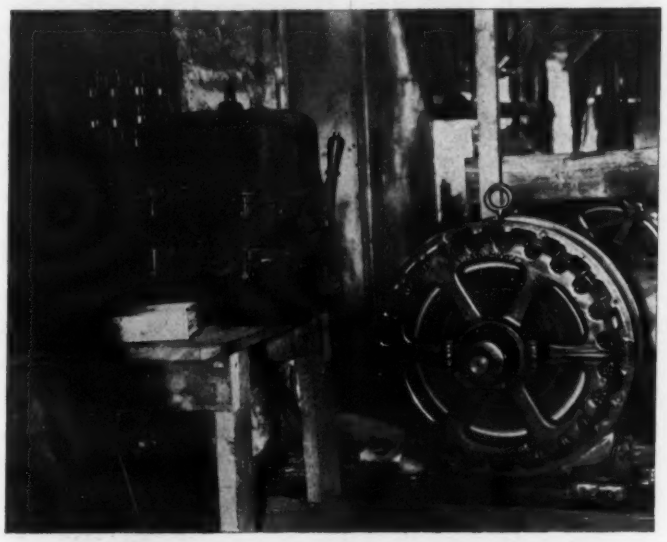
FIG. 2.—PARTS OF JACK BOX.



FIGS. 3 AND 4.—CROSS-SECTIONS OF BOX.

Electricity in the Manufacture of Metallic Caskets.

Electricity as a motive power for the operation of industrial plants has, by its obvious advantages, come into general use in all branches of manufacturing. The simplicity of electric motors,



MOTOR FOR METALLIC CASKETS.

the ease with which they can be applied to almost any class of work and the flexibility attending their use has created a large field for electric drive which is rapidly superseding the methods formerly used. An illustration of this fact is found in the plant of the Springfield Metallic Casket Co., of Springfield, Ohio, where the rapidly increasing business created power demands that were considerably in excess of the steam engine equipment and electric motors were installed in preferenc to additional steam capacity. This company manufactures high grade metallic caskets with self-locking covers that cannot be removed when once placed in position.

The electrical equipment consists of two Westinghouse 50-hp induction motors, which are belted to line shafting that in turn drives various machines. This is only one of the many instances where progressive companies have shown appreciation of the superiority of electric drive that led to its adoption.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The generally finer and cooler weather of the past week has brought with it a great deal of activity in all staple lines of consumption, and both wholesalers and retailers make most encouraging reports as to conditions. There is every indication that the country will enjoy an unusually busy winter and that trade will be limited only by the capacities of manufacturing plants to produce and of the railroads to deliver goods within a reasonable time. Yet, in spite of ali this activity, there is hardly any quarter in which there can be said to be a dangerous boom except in mining and in real estate. But the latter craze seems to have died down a good deal, while the mining development has been stimulated by the reports from very profitable enterprises and by the remarkably high prices of such metals as copper and iron. Last week copper advanced to 21¼ cents in New York and to 98 pounds a ton in London, and many of the leading dealers are getting a bit shy of long range prices; while in the electrical field this further advance has been viewed with anxiety as taking the edge off recent contracts. It is said that there is less old copper in the market to-day than at any time since the Civil War. In the iron and steel field activity and scarcity are equally pronounced, and it is reported from Pittsburg that it is difficult to buy iron of any grade for delivery this side of July 1, 1907. In spite of the fact that the rail production this year will exceed all former years, a large tonnage will have to be carried over to next year. But fortunately in rails and in other finished lines there does not appear to be a prospect of much advance in prices, owing to the regulating influence of the leading interest. Railway earnings for the period are reported as 8.1 per cent ahead of last year, bank exchanges in New York were 1.9 per cent larger, and the week gain in exports was not less than $6,000,000. *Bradstreet's* reports that the business failures for the week ending October 11 were 192 compared with 183 in the corresponding week of 1905 and 196 in 1904.

ALLIS-CHALMERS STEAM TURBINE SALES.—Recent purchases of steam turbine-generator outfits of Allis-Chalmers manufacture include a number of units of capacities ranging from 500 to 750 kw. Among others the Flatbush Gas Company, of Brooklyn, will install in the Flatbush power station, Brooklyn, a 750-kw Allis-Chalmers steam turbo-generator set for operation at 1,800 r.p.m., 2,200 volts, 60 cycles, two-phase, under a steam pressure of 150 lb. The turbine for this unit will conform to the well-known standard of Allis-Chalmers construction, while the generator will be of the enclosed type, ventilated by means of air forced into the interior. The Savannah Lumber Company, of Savannah, Ga., will install a 500-kw turbo-generator set and a 15-kw exciter driven from a high-speed engine. The new units will operate under 150 lb. steam pressure at a speed of 3,500 r.p.m., 2,400 volts, 60 cycles, two-phase. Hall & Co., owners of the Jamestown Worsted Mills, Jamestown, N. Y., have recently purchased through their agents, W. S. Barstow & Co., a 500-kw Allis-Chalmers turbo-generator set for operation under 150 lb. steam pressure at 3,600 r.p.m., 480 volts, 60 cycles, three-phase.

SALES OF PEERLESS MOTORS.—The Peerless Electric Company, of Warren, O., reports business brisk in the motor line. This concern has recently furnished the new plant of The Sherman Envelope Company, Worcester, Mass., with sixty-two individual motors, making a model equipment. The Gospel Trumpet, Anderson, Ind., is putting in 23 Peerless motors and a large alternating-current-direct-current motor generator set. The Hinde & Dauch Paper Company at Sandusky, O., are installing 66 motors and several more at their Hoboken plant. A contract has just been taken by The Peerless Electric Company to equip the machinery of the manual training school at Greenville, O., with variable speed individual motors. Peerless motors are being placed in the new Sinton Hotel at Cincinnati, to operate the ventilating fans and pumps. Among other jobs just being completed are individual motors for the Cadillac Printing Company, Detroit,; Elgin Dairy Report, Elgin, Ill., and Grover Bros., Newark, N. J.

TELEPHONES IN THE SOUTH.—More than 100,000 Bell telephones are now in use on lines owned by the Southern Bell Telephone & Telegraph Company in the seven Southern States in which this company operates. The 100,000 mark was reached and passed during the week just closed, and establishes a new record in the development of the South. These telephones are in addition to almost 30,000 telephones used by sub-license companies and connected with the lines of the Southern Bell Company. The States through which these telephones are scattered are Georgia, Florida, Alabama, North Carolina, South Carolina, Virginia and West Virginia. The area covered is very wide and the development compares favorably to the density of the population. The 100,000 telephones are divided among the seven States as follows: Alabama, 22,033; Florida, 5,145; Georgia, 31,651; North Carolina, 8,738; South Carolina, 10,648; Virginia, 18,835; West Virginia, 3,371; total, 100,421.

TENNESSEE COBALT.—A statement from Nashville in the *Iron Age* as to mining in the State says: "Another mining industry that bids fair to become a dividend earner is the cobalt mines. A few months ago Thomas A. Edison sent experts into some of the counties of Tennessee to prospect for cobalt, which has been found in very considerable quantities. We judge that Mr. Edison is certainly very much interested in the territory from the reports he has received, from the fact that he has recently made a personal visit to this section and thoroughly inspected the cobalt properties on which he has received reports. He still has his men in the field further prospecting the entire section. He expresses himself as being well pleased with what he has seen and thinks the cobalt which will be mined from this locality will greatly aid in the development of electricity in this country."

W. S. BARSTOW & COMPANY, of New York and Portland, Ore., have been retained as consulting engineers by the Washington (Ore.) Water Power Company to design their new steam plant. This is a relay plant and is for the purpose of the insurance of good service, particularly in case of any accident to the transmission lines of the various water power plants of the company. The present installation will be about 8,000 hp. Steam turbines will be used for current generation and the plant will be modern in every respect. The Washington Water Power Company was one of the original pioneers in long distance transmission, one of its transmission lines extending into the Coeur D'Alene country, a distance of about one hundred and ten miles and having a potential of sixty thousand volts.

GENERAL ELECTRIC MOTOR CARS.—The Boston office of the General Electric Co. has recently received an order amounting to over $1,000,000, and calling for 400 motor car equipments, for which 100 are for the Boston Elevated, 125 for the Massachusetts Electric Cos., and about 200 for properties under Stone & Webster's management. All the motor equipments will be used for next summer's rolling stock.

WIRELESS FOR THE SUN OIL COMPANY.—The Sun Oil Company of Philadelphia have closed negotiations for wireless equipment on their steamships *Toledo* and *Paraguay*, plying between Philadelphia and Port Arthur, Texas. If the service on these two vessels prove satisfactory the Sun Oil Company will have their entire fleet of steamships and barges equipped with wireless. The De Forest system will be used.

LOW PRICE FOR GAS.—The Wichita Gas, Electric Light & Power Co. is considering reducing the price of artificial gas to 27 cents per M. feet until it brings in natural gas for distribution through its mains. This company has secured and has under lease a large acreage of gas land, and is now drilling wells, and expects to be able to deliver natural gas to its customers by January 15th.

LAKE SHORE ELECTRIC RAILWAY.—The Lake Shore Electric Railway Co., of Cleveland, O., has recently inaugurated a number of extensions to its lines, as well as additions and improvements in the power equipment of its system. The road belongs to the Everett-Moore syndicate. The company has contracted for $250,000 worth of new apparatus from the Westinghouse companies.

MECHANICAL DRAFT APPARATUS as a substitute for chimney draft has recently been bought from the B. F. Sturtevant Company, of Boston, by the Suburban Electric Light Company, Scranton, Pa.; Dearborn Power Company, Chicago, Ill.; Trinidad (Colo.) Electric Railroad Company and the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md.

WESTINGHOUSE EXPANSION.—An official statement is made that the Westinghouse Electric & Manufacturing Company proposes to add 1,000,000 square feet of floor space to its East Pittsburg works and foundry plant. This, including construction under way, will give the Westinghouse company a total floor space of more than 4,000,000 square feet. The floor space of the Westinghouse company, including extensions under way, now aggregates 3,044,000 square feet. Not long ago the floor space of the company was given as 2,000,000 square feet.

Financial Intelligence.

THE WEEK IN WALL STREET.—Another busy week has been experienced in Wall Street, and a total of 5,352,459 shares were sold. There was a good deal better and easier feeling, due to the fact that money market conditions were much easier, so that for the first time since the middle of August sixty-day loans could be placed for less than 6 per cent. In like manner the call money rate, which touched 40 per cent during the first week in September and ranged around 7 per cent during the month, did not rise above 4½ per cent last week. In spite of the fact, therefore, that the Bank of England has fixed a 5 per cent rate in place of the 4 previously prevailing, a general opinion prevails that we shall now have fairly easy money up to the end of the year, which, of course, will have a beneficial influence on stocks Meantime the general activity in trade and commerce and the widespread prosperity of the country are exhibiting themselves in the excellent earnings of the railroads and public utilities, and this gain is reflected in the price of all securities. At the same time, Wall Street dealings appear to be on a relatively conservative basis, for in spite of the advances in dividends it can hardly be said that prices have gone up proportionately. Possibly no real advance in the market will be seen until the elections have determined whether clean and conservative policies shall prevail in the State or whether principles shall rule that are inimical to corporate interests. The announcement was made during the week of the intention to issue a large amount of new General Electric stock, namely, $20,000,000, called for by the enormous increase in business and the necessity for greater facilities of production. The effect of this was, however, by no means unfavorable to the stock, as on dealings in 33,500 shares it closed the week at 179½. As the new stock will be issued at par, the rights are, of course, valuable. Westinghouse Electric & Manufacturing Company, on dealings in 8,700 shares, also showed a good advance, namely, from 154½ to 156. During the week the stockholders of the Western Union Telegraph Company authorized the expected increase in its obligations, but this gain was favorably received and the stock closed at 86⅛. All the public utilities were strong throughout the week, and the reports of earnings and of traffic were favorable without exception. The closing quotations of October 16 are given in the accompanying table.

NEW YORK

	Oct 9	Oct. 16		Oct 9	Oct. 16
Allis-Chalmers Co.	17⅜	17	General Electric	181	178⅝
Allis-Chalmers Co. pfd.	46¾	44	Hudson River Tel	...	...
American Dist. Tel	25	25	Interborough Rap. Tran	...	...
American Locomotive	76¾	76¾	Mackay Cos.	73	70¾
American Locomotive pfd.	112	112	Mackay Cos. pfd.	70	70¾
American Tel. & Cable	90	87	Marconi Tel	...	...
American Tel & Tel.	...	...	Metropolitan St. Ry	...	...
Brooklyn Rapid Transit	78¾	79⅛	N. Y. & N. J. Tel.	...	...
Electric Boat	15	15	Western Union Tel.	86⅜	86¾
Electric Boat pfd.	60	60	Westinghouse com	159	154
Electric Vehicle	11	11	Westinghouse pfd	...	...
Electric Vehicle pfd	18	18			

BOSTON

	Oct. 9	Oct. 16		Oct. 9	Oct. 16
American Tel & Tel.	136¾	136⅜	Mass. Elec. Ry. pfd	70	70
Cumberland Telephone	...	...	Mexican Telephone	7	...
Edison Elec. Illum.	235	235	New England Telephone	...	130
General Electric	184¼	178¼	Western Tel. & Tel.	10	...
Mass. Elec. Ry.	18	18¼	Western Tel. & Tel. pfd	85	85

PHILADELPHIA

	Oct. 9	Oct. 16		Oct. 9	Oct. 16
American Railways	51⅛	51⅛	Phila. Electric	8⅛	8⅞
Elec. Co. of America	11⅜	12¼	Phila. Rapid Trans.	28¼	28⅜
Elec. Storage Battery	73	71⅛	Phila. Tracion	97⅞	...
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Oct. 9	Oct. 16		Oct. 9	Oct. 16
Chicago City Ry.	140	140	National Carbon	85	...
Chicago Edison	...	145	National Carbon pfd.	115	...
Chicago Subway	...	53	Union Traction	...	...
Chicago Tel. Co.	...	...	Union Traction pfd.	...	...
Metropolitan Elev com.	26	...			

SALE OF CHICAGO EDISON.—Advices from Chicago state positively that negotiations for the acquisition of the Chicago Edison Company by the Chicago Subway Company have reached a definite stage. Conferences between the interested parties have been held over the last several weeks, and an understanding may be reached within the next few days. Preceding this announcement will be an official statement bearing on an important telephone deal in which the Chicago Subway plays the leading role. The Chicago Edison Company controls the electric lighting situation in Cook county and supplies light to a population of 2,000,000. The earnings of the Chicago Edison Company have been increasing rapidly over the last few years. The report for the year ended March 31, 1906, shows over $1,550,000 net on a gross business of about $4,750,000. Dividends at the rate of 8 per cent. have been paid since 1899. It has been necessary to increase the capital stock from time to time in order to accommodate the growing business of the concern. The authorized capital stock of the company is $15,000,000. There are $6,000,000 first mortgage 5 per cent. bonds redeemable at par after July 1, 1910, of which $5,500,000 are outstanding. There are also $1,483,000 debentures redeemable at par. In March of this year the stockholders subscribed for $1,775,800 additional stock which raised the capital to the figures given above. The capital stock of the Chicago Subway Company aggregates $50,000,000, of which $40,000,000 has been issued. The Illinois Tunnel Company is the operating company. Its capital stock, owned by the Chicago Subway Company, aggregates $30,000,000. There are $30,000,000 5 per cent. bonds authorized, of which $17,000,000 are issued. Stock of the Chicago Subway Company is owned by interests in practically every railroad entering or leaving Chicago.

DIVIDENDS.—The Michigan State Telephone Company has declared the regular quarterly dividend upon its preferred stock of 1½ per cent, payable November 1. The directors of the American District Telegraph Company, of New Jersey have declared the regular quarterly dividend of 1 per cent, payable October 22. The directors of the United Electric Securities Company have declared the regular semi-annual dividend of $3.50 a share on the preferred stock, payable November 1. Stone & Webster, of Boston, Mass., announce that semi-annual dividend of $2.50 per share has been declared payable on the capital stock of the Edison Electric Illuminating Company, of Brockton, November 1. They also announce that a semi-annual dividend of $4 per share has been declared payable on the capital stock of the Lowell Electric Light Corporation November 1. The directors of the Edison Company of Boston have declared the regular quarterly dividend of 2½ per cent payable November 1. The directors of the American Graphophone Company have declared a regular quarterly dividend of 1¾ per cent. on the preferred stock, payable November 15. Directors of the United Traction Company November 15. Directors of the United Traction Company have declared the regular quarterly dividend of 1¼ per cent, payable November 1. Directors of the Southern New England Telephone Company have declared a regular quarterly dividend of 1¼ per cent., payable October 15. The West Penn Railways Company has declared a quarterly dividend of 1¼ per cent, payable October 27.

TRUCKEE RIVER POWER.—President Mortimer Fleishhacker, of the Reno Power, Light & Water Company, and of tributary power concerns on the Truckee River, which jointly control the supply of electrical power and lights of Reno, Carson and Virginia City, has visited New York to close a deal whereby Eastern capitalists are to purchase the various companies at present controlled by the Fleishhackers. He was to meet C. W. Waller, the electrical engineer in charge of the local corporation, in Chicago, and with him complete the deal with the New York syndicate on arrival in that city. Mr. Fleishhacker says the price to be paid is $5,000,000, and the transfer includes the Reno Power Company, the Truckee General Electric Company, the American River Electric Company and the Nevada Transit Company, which operates an electric line between Reno and Sparks.

EXTENSIONS AT LOWELL, MASS.—The extensions proposed by the Lowell Gas & Electric Corporation with its new $325,000 of stock include the following: Motors, transformers and short extensions to end of year, $6,460; power line, $1,080; water meters, $500; Middlesex Village extension, $4,200; North Chelmsford extension, $2,815; grounding of secondary line, $3,500; underground cables now being installed, $31,753; 1,500-hp boilers, $39,000; stack, $12,840; extension to buildings, $60,000; coal pockets, $27,000; turbines, $50,000; Dracut extension, $6,750; station for former business, $10,640. To carry out agreement with the city, $75,000. The last price of stock fixed by the board was at $145 per share. The total amount of expenditure projected

WESTERN UNION FINANCES.—The Western Union Telegraph Company for the year ended June 30 last has reported an increase of about 4,000,000 messages transmitted over its wires and a gain of $1,642,020 in its gross receipts for the year. The net earnings for the twelve months amounted to $7,070,583, a decrease of $117,482, due to largely increased expenses, reflecting among other things larger expenditures out of earnings for the improvement of the property. The surplus for the year after the payment of dividends was $874,519, compared with a surplus of $1,092,781 for 1905. Discussing the improvement work done in the year, President Clowry says in his report to the stockholders: "The large increase in the revenues for the year has warranted a continuance of the policy of making liberal appropriations from earnings for raising the standard and improving the stability and operating efficiency of the lines. The expenditures for these purposes and for the general maintenance and repair of the lines during the year amounted to $4,422,690, an increase of $703,626 over last year. A large part of this amount was devoted to the betterment of the property, and might with propriety be charged to capital account." In the year $111,000 collateral trust bonds were issued in exchange for a corresponding amount of capital stock of the Maine Telegraph Company, upon which, under lease of that company, interest was being paid at the rate of 10 per cent a year. The Western Union stockholders, at a special meeting last week, ratified the proposed issue of $25,000,000 of new 4 per cent convertible bonds, the proceeds of which will be employed for the general development of the company's business.

GENERAL ELECTRIC STOCK INCREASE.—The General Electric Company has voted to increase the capital stock by $20,000,000, making the total amount $80,000,000. Of this amount $11,000,000 will be offered to stockholders at par. The new stock will be used for extensions and increasing the working capital of the corporation. Holders of five shares of the old stock are entitled to one share of the new stock to be issued. The General Electric Co. will expend next year between $5,000,000 and $6,000,000 for extensions. Extensions already under way, and which are being met from the proceeds of the stock authorized last year, will give the company an additional floor space of about 1,150,000 square feet, making a total of 5,500,000 square feet. This is largely in the new steam turbine shop. A special meeting of the General Electric stockholders will be called on November 20 to authorize the increase in stock proposed by the directors. The issuance of about $11,000,000 additional stock by the General Electric Co., conferring rights upon stockholders estimated at $13.50, makes a total of $28 in rights which stockholders have received during the past three years, equal to $9 per share yearly, and making the total return per share, including dividends, over $17 yearly for the last three years.

HARRISBURG, PA., SYSTEM.—The transfer of the properties of the Harrisburg Light, Heat & Power Company to the Harrisburg Securities Company, a concern formed to take over the Harrisburg Company's lighting plant and system, is set for October 15. A. N. Williamson, who is at the head of the company which is to give collateral trust bonds for the Harrisburg Company's stock, on his recent visit to Harrisburg, said: "Owing to the unavoidable delay in perfecting the details in connection with the organization of the Harrisburg Securities Company, the new company purchasing the stock of the Harrisburg Light, Heat and Power Company, and the inability to secure the engraved bonds and stock in time to make the transfer September 1, an extension of time has been requested by the New York parties to October 15 and will, no doubt, be granted by the stockholders. No change, whatever, has been made and the transfer will take place as of September 1, from which date interest on the bonds will commence." Subscriptions have been received for the stock which is to be issued by the Harrisburg Securities Company to make improvements.

DEAL AT SOUTHBRIDGE, MASS.—Negotiations have been practically completed whereby Southbridge will see a change in the ownership of the gas and electric light service beginning October 15. A representative of the firm of Drury & Bonney, Worcester, acting for Lee, Higginson & Co., Boston, has made arrangements with the stockholders of the Southbridge Gas & Electric Company whereby they will sell their stock to the brokers at 62½, par value 50, the transfer to take place October 15, at which time the buyers will take over the plant. The Southbridge Gas & Electric Company was formed in 1871 with a capital of $50,000 divided into 1,000 shares of stock at a par value of $50 a share. The president is Henry C. Cady and the treasurer George W. Corey. The company has been successful ever since its formation, and during the past few months has been spending a lot of money in improvements.

THE FEDERAL TELEPHONE COMPANY, of Cleveland, O., which formerly held control of the Cuyahoga Telephone Company, United States Telephone Company and a large number of independent companies in Ohio, being the holding company of the Everett-Moore syndicate, has practically passed out of existence. At a meeting held last week the capital stock was reduced from $1,000,000 to $10,000. Originally the capitalization was $10,000,000. The properties controlled by the company have all been sold and the greater portion of the debts liquidated. At one time the stock of the company sold as high as $41.00 a share and at present it is valueless.

WESTERN UNION-BELL.—Although the case of the Western Union Telegraph Co. against the American Telephone & Telegraph Co. has now been before Mr. Everett W. Burdett in Boston, as master, for over three years there is little prospect of a settlement for another year at least. Western Union interests believe that they will benefit to the extent of at least $2,000,000 as a result of the accounting under the interpretation of the famous old contract by which the company agreed to quit the telephone field. Whenever received this should benefit the Western Union stockholders.

CHICAGO EDISON BONDS.—N. W. Harris & Co. has offered $125,000 Chicago Edison first mortgage 5 per cent. gold bonds at 101 and interest. These bonds are secured by a first mortgage on the entire property, rights and franchises of the Chicago Edison Company, the net earnings of which are more than five and one-half times its interest charges. For more than seventeen years the company has paid annual dividends of 8 per cent. on its capital stock. At current quotations the capital stock represents an equity of more than $17,000,000 over and above the bonded debt.

HUDSON RIVER POWER.—The report of the Hudson River Electric Power Company for August and the 12 months ended August 31, compares as follows:

	1906.	1905.	Increase.
August gross earnings	$79,914	$76,542	$3,371
Operating expenses	44,279	34,363	9,915
Net earnings	35,635	42,178	*6,543
Twelve months gross	846,128	666,506	179,622
Operating expenses	460,426	390,676	69,750
Net	385,702	275,830	109,872

*Decrease.

DETROIT EDISON BONDS, first mortgage, 5 per cent gold, are being offered by Perry, Coffin & Burr, of Boston; Spencer, Trask & Co. and N. W. Harris. The amount is $327,000 of a total issue of $6,275,000. The capital stock outstanding is $5,000,000. The gross earnings for the year ending August were $997,343, the net were $396,814 and the bond charges during the period were $272,020, leaving a surplus for stock of $124,793. Under Mr. Alex Dow the business of the company is growing very rapidly.

ANOTHER CINCINNATI DEAL.—The Eastern syndicate which has recently leased the Cincinnati Gas & Electric Company is reported to be negotiating for the Cincinnati, Newport & Covington Light & Traction Company. It is said that the syndicate will shortly submit a proposition guaranteeing dividends on the common stock of the C. N. & C. L. & T. Company on a graduated scale beginning with 3 per cent. The property is earning close to 7 per cent on the common stock.

ELMIRA, N. Y., CAPITAL.—The New York State Commission of Gas and Electricity has received the application of the Elmira Water, Light and Railroad Company for consent to execute a new first consolidated mortgage for $5,000,000 and to increase its capital stock from $1,000,000 to $2,000,000. The applicant has already received the consent of the Railroad Commission to the increase of stock and to the issue at present of $3,605,000 of the bonds.

CINCINNATI BELL STOCK.—The directors of the Cincinnati & Suburban Bell Telephone Company have authorized the issue of treasury stock to the amount of $325,000, the money realized to be voted to paying for a number of improvements and extensions. The stock will be allotted pro rata to present stockholders at par.

INGERSOLL-RAND CAPITAL.—The Ingersoll-Rand Co., in making application to list $2,000,000 of its 5 per cent bonds, $4,500,000 preferred stock and $3,000,000 common stock, shows a net income in the past six months of 1906 of $2,669,498; and an estimated addition of the surplus, after all charges and dividends, of $230,727.

VIDALIA MUNICIPAL BONDS.—The town of Vidalia, Ga., will hold an election October 24, upon a proposed issue of $25,000 water-works and electric light bonds.

GENERAL NEWS.

Construction News.

MOBILE, ALA.—The date of opening bids for constructing the municipal electric light plant has been extended from Oct. 1 to Nov. 12. Address Patrick J. Lyons, Mayor.

FORT SMITH, ARK.—Mrs. Fannie Cohn has applied to the City Council for a franchise to construct and operate an electric light plant in this city.

FULLERTON, CAL.—The Constructing & Engineering Company has applied to the Trustees for a franchise to construct a local telephone system.

VALLEJO, CAL.—A special election will be held before the end of the year to determine if the City charter shall be amended, so as to allow the city to own and operate street railways, electric light, gas and telephone enterprises.

PASADENA, CAL.—S. F. Pearson, City Engineer, writes that all bids opened on Sept. 25 for constructing a generating station for the municipal electric light plant have been rejected and new bids will be received by Heman Dyer, City Clerk, on Oct. 23. William Reeves is City Electrician.

FRESNO, CAL.—T. J. Boyd, promoter of the Merchants Independent Electric Company, states that his company has acquired the Fort Miller Power Company's rights on the San Joaquin River. The company will construct an electric plant at this place with transmission lines at a cost of about $1,000,000.

REDDING, CAL.—Work has commenced in Shasta County on a hydroelectric plant that entails an expenditure of $7,000,000. The company interested in the project is connected with the Western Pacific Railroad Company and Thomas B. Walker. Through R. E. Johnson the company has filed on 150,000 inches of water from Pitt River. The scheme contemplates diverting this volume of water from Pitt River near Peck's Bridge and conveying it by a ditch eight miles long, seven miles of which will be in a tunnel through Haynes Mountain, to a large power plant to be erected in the Big Bend country near the site of the Redding & Big Bent Lumber Company's mill. The electricity generated will be used in operating railroads through the Walker timber holdings.

DANBURY, CONN.—The New Machine Company is installing two electric motors to operate the machinery in its factory on Crosby Street.

MILFORD, CONN.—At the annual town meeting held recently the citizens voted to increase the appropriation for street lighting by $5,000.

CANAAN, CONN.—It is reported that the Connecticut Railway & Lighting Company has purchased the water power and privileges of the Falls Village Water Power Company, of Falls Village.

GLASTONBURY, CONN.—The contract for the building of the hydroelectric plant of the Glastonbury Power Company on the upper part of Roaring Brook has been awarded to J. G. White & Company, of New York., N. Y. A dam 600 feet long and 60 feet high will be built across the brook and the water carried through a 54-inch wooden flume to the power house two miles away. Two spiral Francis turbines of 750 hp. each will be installed, working under a 200-foot head, and electricity will be transmitted to Glastonbury for light and power. It is expected that the plant will be ready for operation by the first of next April.

MIDDLETOWN, CONN.—The Middletown Electric Light Company has completed arrangements with a Providence company to supply it with electricity for lighting and also for operating the street railway system. The electricity will be generated at Leesville, on the Salmon River, 15 miles away, where the Providence company has recently acquired valuable water rights, and has drawn plans for a large power plant. It is expected that it will require at least eight months to complete the work, including the construction of two dams, one at Leesville and one at Marlborough, where a reserve reservoir will be built. William Burrows is president of the Middletown Electric Company.

WILMINGTON, DEL.—The new DuPont office building at Tenth and Market Streets will be equipped with a complete electric lighting plant of its own, consisting of three dynamos having a total capacity of 225 kw. The Crocker-Wheeler Company, of Ampere, N. J., will furnish the electrical machinery.

WILMINGTON, DEL.—The Pusey & Jones Company is preparing to replace steam power by electricity in several departments of its plant. The company is preparing to install two dynamos of 125 kw each for generating electricity for the plant. For the present the company will purchase electrical energy from the Wilmington City Electric Company.

WASHINGTON, D. C.—The plant of the National Electric Supply Company was completely destroyed by fire Oct. 8, together with the several buildings of the Marine Railway & Coal Company, situated at the foot of Franklin Street. The loss is estimated at $5,000. The work of rebuilding of the plant, it is stated, will commence as soon as the loss can be adjusted.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 13, to furnish at the Navy Yards, New York, N. Y.; League Island, Pa., and Puget Sound, Wash., a quantity of generating sets and spare parts, gun-elevating and turret-turning motor generators. Applications for proposals should refer to Schedule 220. H. T. B. Harris, Paymaster-General, U. S. N.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 30, to furnish at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C.; and Norfolk, Va., materials as follows: Schedule 202—transformers, etc. Schedule 204—electrical wire and supplies, alundum wheels, recoil springs, phosphor bronze, sheet copper, etc. Schedule 205—motors, etc. Schedule 206—motors, portable electric drills, magnesia pipe covering, asbestos millboard, tar paper, iron coil, etc. Application for proposals should designate the schedule desired by number. H. T. B. Harris, Paymaster General, U. S. N.

COLUMBUS, GA.—The Columbus Automatic Telephone Company has placed an order for additional equipment for its exchange at a cost of $5,000.

DOUGLAS, GA.—The citizens on Oct. 6 voted in favor of issuing additional bonds for extending or enlarging the water works and electric light plant.

ELBERTON, GA.—A new 110-kw dynamo will be installed in the municipal electric light plant to increase the capacity of the plant to meet the increasing demand for electric light. G. W. Hubbard is superintendent.

WAYCROSS, GA.—A dynamo has recently been installed in the water works station to supply electricity for lighting the public buildings. The question of municipal ownership of an electric lighting plant will soon be taken up by the Mayor and the Council.

ATLANTA, GA.—The North Georgia Electric Company has completed its transformer station on North Boulevard road and the erection of the steel towers for the transmission line from the power plant on the Chattahoochee River near Gainesville to Atlanta. The company has also commenced the construction of its underground conduit system and expects to be ready to supply electricity in this city by next spring.

VIOLA, ILL.—A franchise has been granted to W. S. Ryan to operate an electric light plant in this place.

MOUNT CARMEL, ILL.—The New Electric Company of this place has changed its name to the New Electric Light Company.

CULLOM, ILL.—It is reported that a company is to be organized to purchase the Ortman electric light plant or establish a new system.

CHICAGO, ILL.—The Warren Construction Company was awarded on Sept. 26 the contract for the construction of the transformer station on the south side of the main drainage channel at Southwestern Avenue, for $43,000.

BELLEVILLE, ILL.—A franchise has been granted by the City Council to the Du Quoin Rapid Transit Company for an electric railway in this city. The company proposes to operate an electric railway from Du Quoin to East St. Louis.

CHICAGO, ILL.—At a meeting of the Council Committee on Gas, Oil and Electric Light, held Oct. 10, it was decided that all bids for the new telephone franchise must be submitted to the Council Committee by Oct. 24. The Chicago Telephone Company's franchise expires in 1909 and it will have an equal chance with other capitalists and corporations.

LINCOLN, IND.—The City Council is preparing to make extensive improvements to the municipal electric lighting plant.

ANDERSON, IND.—The Union Telephone Company is preparing to place its wires underground and make other improvements.

INDIANAPOLIS, IND.—The Central Union Telephone Company has been required by the Council to place its wires underground.

CAMBRIDGE CITY, IND.—The directors of the Cambridge City Telephone Company will receive bids for wire and material for constructing an additional line to Richmond.

MILFORD, IND.—The City Council has voted to erect and install a new electric lighting plant. The power will be secured from the power house on the Elkhart River at Benton.

RICHMOND, IND.—The Dayton, Ohio, Construction Company has been awarded the contract to erect a new exchange building for the Home Telephone Company, in which the company proposes to install a new automatic system.

LAFAYETTE, IND.—The directors of the Lafayette Telephone Company, the Independent system, has submitted plans and specifications for an elaborate exchange to cost about $120,000. The contract will probably be awarded within a week or two.

INDIANAPOLIS, IND.—Frank Andrews, of Woodburn, Ind., has been appointed the Indiana representative for the Antwerp Telephone Company, an Ohio corporation, which is extending its lines into Indiana. The company has a capital of $20,000 invested in Indiana property.

GARY, IND.—The General Electric Company has secured the contract for three 2,000-hp induction motors to be used to operate the large rail mills of the Illinois Steel Company at Gary. The contract involves more than $250,000. The General Electric Company also closed another con-

tract with the steel corporation for between 30 and 40 low power motors to operate all the ore handling apparatus which will be installed in the plant in this place. This is a separate contract from the high power motors and will involve a large expenditure of money.

SULPHUR, IND. TER.—H. V. Hinckley, vice-president Sulphur Light & Power Company, writes that it is proposed to expend about $30,000 in improvements, to include new generators and boilers.

PAULS VALLEY, I. T.—Owing to financial difficulties the Washita Electric Light & Gas Company, which has been operating an electric plant in this city for the past four years, has been forced to close down its plant and the city is now without lights. The City Council has revoked the franchise of the company, and it is understood that application for a franchise will soon be made by a newly formed company.

MARBLE ROCK, IA.—Fred W. Smith has been granted a franchise to establish an electric light plant in this town.

WAPELLO, IA.—Ora Vaught, of the Wapello Electric & Power Company, writes that the proposed plant will cost about $10,000. The franchise has not yet been procured.

LEAVENWORTH, KAN.—The People's Home Telephone Company has awarded the contract for the construction of its new plant at Sixth and Delaware streets to R. B. Yoakum. The building with equipment will cost about $20,000.

MILO, ME.—The new power house of the Milo Electric Light & Power Company is nearly completed. The company has had some difficulty in supplying sufficient electricity for lighting the town, but will soon be in a position to meet all demands.

TURNER, ME.—E. L. Staples is installing an electric light plant in his box factory, and will furnish electricity in Turner Village and Turner Center. It is expected that in the near future the town will install electric lamps on all the principal streets.

YORK, ME.—Owing to the increasing demands for electricity for lighting during the summer months the Agamenticus Light & Power Company will make extensive improvements to its station, which will nearly double the present capacity of the plant. A new engine, dynamo and two boilers having a capacity of 250 hp each will be installed. A. B. Varney is superintendent.

HYATTSVILLE, MD.—At an election held Oct. 10 the citizens approved the ordinance recently passed by the Mayor and Council granting the Potamac Electric Power Company, of Washington, a 10-year franchise to furnish electricity for private and commercial lighting in this place. Work has commenced on the plant, which will also furnish electricity for street lighting, and it is expected to have the system in operation within the next 60 days.

BALTIMORE, MD.—Another one of the large engines has been placed in the Westport power house of the Consolidated Gas, Electric Light & Power Company. There are now four engines in operation, having a capacity of 4,500 hp each, making an aggregate of 18,000 hp. There is still another large engine to be installed, which will have a capacity of 11,250 hp, and is expected to be in operation early in the winter, when the plant will have a maximum capacity of about 30,000 hp. The company is now building an addition to the boiler house, in which eight new boilers will be installed having a capacity of 750 hp each.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company has petitioned the city for extensive franchises for its conduit system.

HANOVER, MASS.—The Selectmen have granted a franchise to the Abington & Rockland Electric Light & Power Company for the extension of its system to this town.

NORTH ATTLEBORO, MASS.—J. M. & C. J. Buckley, of Worcester, have secured the contract for the construction of the power house for the municipal electric light plant.

LEOMINSTER, MASS.—Several manufacturing firms in this place are making arrangements to operate their plants by electricity. The Leominster Electric Light & Power Company is installing motors in the factories of Lothrop & Walter, George M. Kendall, Miller & Wells, and will also install motors in the factory of Viscoloid Company as soon as the new addition is completed. Charles F. Young is superintendent of the electric company.

SOUTHBRIDGE, MASS.—The stock of the Southbridge Gas & Electric Company will be transferred to Drury & Bonner, Worcester, on Oct. 15, and immediately after the Southbridge plant and the Webster Electric Company, of Webster, will be managed in conjunction. Herbert S. Shaw, general manager of the Webster Electric Company, will be appointed general manager of the Southbridge plant. Andrew E. Hall will remain as superintendent of the Southbridge plant. It is stated that the new management will soon make reductions in both gas and electricity in Southbridge. Some important changes will be made in the service, and it is expected that within two months that an all-night electric service will be given.

PAW PAW, MICH.—W. H. Mason, village clerk, writes that all bids opened on Sept. 17 for constructing water works and an electric light plant have been rejected and the matter has been deferred until the spring.

HANCOCK, MICH.—The Copper Range Consolidated Mining Company is contemplating the erection of an electric power plant at Portage Lake, to furnish electricity for operating the adjacent mines. The plant will cost about $500.000.

LANSING, MICH.—Work will soon commence on the surveys for the construction of an electric railway from Lansing to Grand Ledge. Professor C. L. Weil, of the Michigan Agriculture College, will have charge of the work. It is expected that the road will be ready for operation during the summer of 1907.

WHITE PIGEON, MICH.—A meeting of Indiana and Michigan business men will be held at White Pigeon for the purpose of perfecting the organization of a company to be known as the Plymouth, Goshen & White Pigeon Railway Company. The company proposes to build an electric railway from Plymouth, Ind., to White Pigeon, Mich., a distance of about 47 miles.

COLDWATER, MICH.—The Southern Michigan Telephone Company is making extensive improvements and additions to its system in this place, which will involve an expenditure of $80,000. The company will place its wires underground in the business section of the city, and erect 20 miles of cables. Coldwater will be the distributing point for Southern Michigan, Northern Ohio and Indiana.

ROCHESTER, MINN.—It is reported that the municipal electric light plant is to be improved and extended.

PRAIRIE HOME, MO.—The Farmers' Telephone Company has filed a statement increasing its capital stock from $3,000 to $5,000.

SENATH, MO.—The Senath Telephone Company has filed a statement showing an increase of capital stock from $1,500 to $6,000.

FULTON, MO.—W. R. Pemberton, city clerk, writes that bonds have been voted and sold for the construction of water works and electric light plant. The probable cost is $15,000 to $20,000. Jacob Wenger is city engineer.

FARMINGTON, MO.—The County Court has granted franchises in St. Francois County to the St. Louis, Montesano & Southern Electric Railway and the St. Louis Southeastern Electric Railway. The proposed route is from St. Louis via Montesano to Flat River, a distance of 80 miles. The St. Louis & Southeastern proposes to build a line from St. Louis to Esther in this county, a distance of about 75 miles. Charles A. Gutke is president of the St. Louis, Montesano & Southern Electric Railway Company.

LIVINGSTON, MONT.—The Livingston Home Telephone Company has been incorporated and will install a plant in this city.

GILTNER, NEB.—Arrangements are being made to construct an electric light plant in this place.

SCRIBNER, NEB.—Bids will be received until Oct. 27 by H. Christy, village clerk, for constructing a water works system, and a lighting and heating plant. Thomas Shaw, of Omaha, is engineer.

RENO, NEB.—The Truckee River General Electric Company, which controls the Reno Power, Light & Water Company, of which P. L. Flanigan, of Reno, is president, has completed plans for two generating stations between Reno and Floriston to supply Western Nevada with electricity for light and power. The new plants will have a capacity of 2,000 and 3,000 hp respectively.

STATESVILLE, N. C.—The National Electrical Supply Company, of Washington, D. C., was recently awarded the contract for equipping a new telephone system in this city at $8,000.

CHARLOTTE, N. C.—The Southern Bell Telephone Company will make extensive improvements to its local system involving an expenditure of $35,000. The company will build an underground conduit system, and erect aerial cables.

GOLDSBORO, N. C.—The commissioners of the municipal electric lighting plant are contemplating moving the dynamos of the city lighting plant to the pumping station on Little River, so as to operate the water and light plant with one set of boilers.

FAYETTEVILLE, N. C.—The Cape Fear Company was sold at auction Oct. 4 to S. Z. Mitchell, vice-president of the Electric Bond & Share Company, of New York, N. Y., for M. C. Humstone, representing the bondholders. The price paid was $250,000. If the sale is confirmed the purchaser will complete the improvement of the property and install a power plant.

RALEIGH, N. C.—The Standard Gas & Electric Company, of this city, has sold its electric plant to the Raleigh Electric Company, and will devote all its attention in the future to the gas supply, having now under way $40,000 in improvements to the gas plant. The Raleigh Electric Company has done the greater portion of the electric lighting in the city, and also operates the street railway system.

HACKENSACK, N. J.—A mortgage has been filed by the Gas & Electric Company of Bergen County, covering all the plant and franchises of the company. Bonds have been issued and improvements will be made to the plant.

BUFFALO, N. Y.—The building of the Century Telephone Company was recently destroyed by fire, entailing a loss of $150,000.

BABYLON, L. I., N. Y.—L. H. Fishel, president Babylon Electric Light Company, writes that the stockholders on Oct. 5 voted in favor of increasing its capital, to be used in the construction of a new plant.

HUNTINGTON, N. Y.—The Huntington Highway Commissioners have granted a franchise to the Huntington Railroad Company for a cross island electric railway. Construction is to commence on the road before April, 1907.

NEW YORK, N. Y.—Bids will be received until Oct. 22 by C. B. J. Snyder, superintendent school buildings, New York City, for installing electric equipment in School 42, Borough of Brooklyn; also in addition to and alterations in School 121, Borough of Manhattan.

FAR ROCKAWAY, L. I., N. Y.—The Queens Borough Gas & Electric Company has announced that on Nov. 15 it will reduce its rates for elec-

tricity 25 per cent. At present consumers are paying 20 cents per kw-hour for electric energy. The new rate will be 15 cents per kw-hour.

NEW YORK, N. Y.—T. Fred Jackson, 592 Columbus Avenue, has secured the contract for electric equipment for addition to School 172, in Manhattan Borough, for $4,086, and Frank E. Gore was awarded the contract for electric equipment to addition to School 66, Borough of Queens, for $3,244.

UTICA, N. Y.—At a meeting of the Common Council held Oct. 10, it was voted to extend and renew the street lighting contract with the Utica Gas & Electric Company for a term of five years. The company agrees to furnish arc lamps for $56 per lamp per year, instead of $109.50, being a reduction of $53.50 on each lamp, which means a saving of $41,248 per year, or $206,242 for five years.

BALDWINSVILLE, N. Y.—The Niagara, Lockport & Ontario Power Company has purchased land near the John Hirzel camp, where a substation 36x24 feet will be erected. The company expects later to erect substations at Fulton, Phoenix and Oswego. The Seneca River Power Company and the Oswego River Power Transmission Company are said to have grants as distributors of the Cataract Power Company.

UTICA, N. Y.—The Hudson River Electric Power Company has submitted a proposition for lighting the streets of the city. The company agrees to construct an electric light plant and system and to furnish for a term of five years from January 1, 1907, the number and kinds of lamps specified in the existing electric lighting contract between the city of Utica and the Utica Gas & Electric Company at the rate of $45 per lamp per year. The company also agrees to pay the city the same price for the use of conduits owned by the city that is paid by the Utica Gas & Electric Company. Under this proposition it is figured that there would be an annual saving of $8,030 and for the full term of the contract the city would save $40,150 on the contract awarded to the Utica Gas & Electric Company Oct. 12. The Hudson River Electric Company bases a request to the Mayor for the vetoing of the contract with the Utica Gas & Electric Company on this ground.

GLENALE, OHIO.—The Village Council has granted a franchise to the Cincinnati Gas & Electric Company to furnish the village with electric light.

DAYTON, OHIO.—J. H. Pfister, electrical engineer, has been employed to make estimates for placing the police and fire department wires underground in this city.

IRONTON, OHIO.—The new owners of the Camden Interstate Railway Company are contemplating the erection of a large power station in this city in the near future.

CINCINNATI, OHIO.—The Cincinnati, Newport & Covington Traction Company has received a proposition to extend its Louisburg line to Erlanger. Property owners offer to give the right of way.

CINCINNATI, OHIO.—City Electrician Jones has recently taken up with the officials of the Union Gas & Electric Company the matter of improving the street lighting system in this city. It is planned to make a number of important improvements to the system.

CUYAHOGA FALLS, OHIO.—The Board of Public Affairs has applied to the Council for an appropriation of $10,000 to repair the municipal lighting plant. Considerable new apparatus is needed, especially a new engine. The plant has but one engine at present.

ZANESVILLE, OHIO.—Plans are being made by the Southeastern Ohio Railway Light & Power Company to extend its line from North and Sixth Streets to the city limits on the Avonsville Road, which will improve the street car facilites in the northern portion of the city. The work will commence at once.

SALEM, OHIO.—The General Engineering Company, of Cleveland, which has a lease on the plant and business of the Salem Lighting & Power Company, has applied to the City Council for a 25-year extension of its franchise. In return for a new grant the company agrees to reconstruct the present plant at an approximate cost of $80,000. An entirely new generating station will be built to furnish 60 cycle, three-phase current for operating lamps and motors. The present lines are to be extended, a 24-hour service is to be given and an entirely new set of enclosed-arc street lamps will be installed. The proposed franchise provides for a maximum rate of 12 cents per kw-hour for electric energy. The company agrees to start work within 90 days after the granting of the franchise.

DUNLO, PA.—The Dale Light, Heat & Power Company, of Johnstown, has secured the contract and is now installing the new machinery in the plant of the Dunlo Light, Heat & Power Company.

JOHNSTOWN, PA.—The Dale Light, Heat & Power Company has been awarded the contract for furnishing all electrical fixtures for the Somerset court house, the cost of which will be between $4,000 and $5,000.

PHILADELPHIA, PA.—John R. Wiggins & Company has been awarded the contract by Wilson, Harris & Richards for the erection of a three-story brick power house, 90x140 feet, for the United Gas Improvement Company, to cost $100,000.

PENNSBURG, PA.—D. K. Graber, burgess has vetoed the ordinance which was passed by the Town Council, submitting to a vote of the citizens at the November election, the question of issuing $10,000 in bonds for a municipal electric light plant.

CHESTER, PA.—The Philadelphia & West Chester Railway Company has completed a survey for a line from Sixty-third and Market streets, Philadelphia, to Media, and thence south to Wilmington. It is stated that work will begin on the road this fall.

DARBY, PA.—At a meeting of the Borough Council, held Oct. 7, a franchise was granted to the Philadelphia Suburban Electric Company to establish an electric plant for the purpose of supplying electricity for light, heat and power. In consideration for the franchise the electric light company will furnish, free of charge, electricity for incandescent lamps in all the fire houses, schools and municipal buildings, and will also furnish and maintain five arc lamps for the borough streets. The construction of the plant will begin within six months, and will be in operation within 18 months.

HARRISBURG, PA.—The American Union Telephone Company, of Pennsylvania, has taken over fifteen independent telephone companies in this State, Southern New York, Eastern Ohio, Maryland and Ohio, and has made arrangements with other independent companies for a long-distance service covering one-third of the United States. The new combination, which is capitalized at $25,000,000, will begin work immediately on extensions, connections and improvements to develop these separate companies into one complete local and long-distance system, which will be the most extensive independent system in the country. The main office of the company will be at 227 Walnut Street, Harrisburg, Pa.

POTTSVILLE, PA.—The Eastern Pennsylvania Railway Company has purchased the electric railway in Pottsville and is planning extensive improvements. Bids are being received for the construction of the addition to the power station of the electric railway in Palo Alto, in which a plant will be installed to furnish electricity for lighting Pottsville, Palo Alto, Schuylkill Valley and other places along the company's system. The company is also contemplating the construction of a power house at Tamaqua and intends to consolidate the plants of the Edison Electric Light Company and the Gas Company, of Tamaqua. The plant at Tamaqua will furnish electricity for lighting the towns along the lines of the Tamaqua & Lansford Street Railway.

NATCHEZ, TENN.—At a recent meeting of the City Council, Mayor Benbrook was authorized to issue a proclamation for a special election on Oct. 9, to vote on a proposition to issue bonds to the amount of $75,000 for a city electric light plant.

KNOXVILLE, TENN.—The Knoxville Railway & Light Company has commenced work on its transmission line to Vestal. The company has closed a contract with the Southern Trunk Company, which is building a new plant in Vestal, to supply it with electricity to operate the machinery of the entire plant. The survey for the proposed extension of the street car to Vestal is completed and the work will be taken up between now and Spring. The company has just completed a transmission line to West Knoxville, and is supplying electricity to the Tennessee Producers Marble Mills and other industries.

PALESTINE, TEX.—The Palestine Electric Light Company is contemplating making improvements to its electric light plant. George W. Burkitt is president.

EL PASO, TEX.—Frank R. Tobin, of St. Louis, has been granted a franchise to build an interurban electric railway from El Paso to Ysleta, a distance of 12 miles.

SALT LAKE CITY, UTAH.—We are informed that contracts are to be let at once by the Salt Lake Public Service Company for its proposed hydro-electric plant, of which Kelsey & Young, of Salt Lake City, are the engineers, and its electric system, steam heating plant, etc., of which W. H. Schott, of Chicago, Ill., is the engineer. The initial cost will be $1,250,000 and the ultimate $2,000,000. James J. Chambers is president.

SALT LAKE CITY, UTAH.—Harrison Clement and V. P. Strange have made application for water rights for a flow of 15 cubic feet per second, to be diverted from Willard Creek in Box Elder County. The diverting work will consist of a channel 8,200 feet long and the water will furnish power for two tangential wheels, which will operate under a head of 1,500 feet, producing a total of 2,500 hp. The power will be utilized to run an electric plant, which will furnish electricity for Salt Lake and Weber counties.

ROANOKE, VA.—The Roanoke Gas & Water Company has decided to issue $800,000 in bonds for the purpose of making improvements and extensions to its system.

MANASSAS, VA.—O. E. Neuman, chairman of the construction committee, writes that J. C. M. Lucas & Company, of Baltimore, Md., have secured the contract for constructing an electric light plant for $7,557.

SCOTTSVILLE, VA.—Arrangements have been practically finished for the installation of an electric lighting plant for the Seaboard Air Line shops in this place. Steam driven machinery will be dispensed with and electric power used entirely in the shops.

ALEXANDRIA, VA.—The United States district court at Baltimore, Md., has confirmed the sale of the property of the Osage Manufacturing Company to the Alexandria Electric Light Company. The consideration was $19,500. The company will erect its new power plant on the above property.

LYNCHBURG, VA.—Sealed proposals will be received by Leon Goodman, chairman of Committee on Lighting, until Nov. 10, for a complete arc lighting plant driven by both steam and water power. The work includes structural steel and concrete work, alternating-currefit generators, switchboard, water wheels, high speed engines, boilers, pumps, piping, steel stack, rope drives, friction clutches, iron stairways, ladders, arc lamps, regulators, lamp-suspension appliances, weather-proof wire and all necessary fittings and appliances. Plans and specifications may be seen and proposal forms obtained from the office of Lamar Lyndon, consulting engineer, 80 William Street, New York, N. Y.

SEATTLE, WASH.—Plans have been submitted to the water and light commission by City Electrician Thorn for a city electric substation, which will combine all the electrical and repair departments of the city under one roof and provide for a power station.

SUMAS, WASH.—The Stave River Power Company is contemplating extending its lines here and to Kendall, to furnish electricity for the cement plant to be constructed at Kendall by the Coleman-Evans interests. The company is also considering the erection of a transmission line from Vancouver to Sumas, Prairie and Chilliwack. The company has a plant of 45,000 hp, and is extending its lines all over British Columbia for the purpose of furnishing electricity for lighting and power.

WAUPAUCA, WIS.—The city has recently installed a new electric pumping apparatus for the water works plant at a cost of $14,000.

WAUSAU, WIS.—The Wausau Electric Company has purchased the Plumer water power. The company has recently added another turbine to its plant, and now has a capacity of 1,400 hp. The Plumer River will afford about 3,000 hp.

SHERIDAN, WYO.—The Sheridan Electric Light & Power Company is contemplating the erection of an addition to its power station.

BATTLEFORD, CAN.—The Council is arranging for the erection of a waterworks building which will accommodate an electric lighting plant. Address R. C. Laurie.

MOYIE, B. C.—Engineers Hermon & Burwell, of Vancouver, have completed plans for the plant of the East Kootenay Power & Light Company, to be constructed on St. Marys River, one mile above Marysville. A substation will be constructed at Cranbrook. One line will be run to Sullivan mine, another to Ft. Steele and another to Moyie; total length of pole line will be 47 miles. The plant will start with 2,500 hp. Directors of the company are Charles A. McKay and J. A. Macdonald, of Moyie, and Leander Show, of Vancouver.

OLDS, CAN.—Special meetings of the City Council are being held to make arrangements for the installation of an electric lighting plant here. Address William Dean.

QU-APPELLE, CAN.—The ratepayers have voted favorably on a by-law to give a franchise to the Moore Milling Company for the installation of an electric light plant here. J. C. Starr is secretary and treasurer.

PORTAGE LA PRAIRIE, MAN.—The Town Council is negotiating with the Winnipeg City Council for the purpose of having electricity transmitted from Winnipeg to Portage la Prairie, a distance of 58 miles. Address F. B. Bradshaw, secretary of Board of Trade, Portage la Prairie, Man.

SASKVILLE, N. B.—The Town Council has decided to take over the electric plant of the Electric Light & Telephone Company, and will conduct it under municipal ownership.

FREDERICKTON, N. B.—The stockholders of the New Brunswick Telephone Company met Oct. 5 and ratified the merger with the Central Telephone Company. Application has been made for authority to increase the capital stock of the New Brunswick company from $600,000 to $2,000,000.

AMHERST, N. S.—The Maritime Coal Company is preparing to install an electric plant in its mines, seven miles from Amherst, and has placed an order with the Canadian Westinghouse Company, of Montreal, Que., for the equipment of the plant. The transmission line to Amherst is nearly completed, and it is expected to have the plant completed and in operation before the first of the year. The company will furnish electricity for manufacturing concerns in Amherst, and also is contemplating the extension of its lines to Moncton, a distance of between 40 and 50 miles, within a short time.

LINDSAY, ONT.—The Town Council has granted a 21-year franchise to the Canadian Machine Telephone Company, of Toronto. The company has installed a system in Peterborough and is now installing one in Brantford.

BRANTFORD, ONT.—The American Machine Telephone Company has been incorporated here with a capital of $450,000 to carry on a general business as a telephone company. The directors are: H. N. Baker, A. E. Knox, A. H. Pafford, Toronto.

FORT WILLIAM, ONT.—The power from the Kakabeka Falls has been turned on. The capital required to carry through the construction work was supplied entirely by C. R. Hosmer, H. S. Holt and F. W. Thompson, all of Montreal. A company will be formed by the promoters with a capital of $5,000,000.

TORONTO, ONT.—The Century Telephone Construction Company has opened an office at 53-9 Adelaide Street and has already secured a large order to equip an independent telephone exchange at Ingersoll, Ont. This company is in the market for telephone cross arms, insulators, toppins, side blocks and galvanized telephone hardware in carload lots, also for telephone cabinet work.

MONTREAL, QUE.—The Canadian Westinghouse Company has secured the contract for the electrical equipment for the addition to the power plant of the Montreal Power & Light Company. The machinery is for the power station on the Soulanges Canal on the St. Lawrence River, and consists of three 3,750-kw alternating-current, revolving field generators, direct connected to water turbines; also two 150-kw direct-current, 125-volt exciter units and thirteen 2,500-kw oil-insulated water-cooled transformers.

SATILLO, MEX.—It is understood that the electric light company is contemplating extensive improvements in the equipment of its plant and service, and that the machinery has been ordered for the plant.

Company Elections.

BUCKLAND, MASS.—At the annual meeting of the Heath Telephone Company, held Oct. 8, the following officers were elected: W. E. Kinsman, of Heath, president; Herbert Newell, of Shelburne Falls, treasurer.

WORCESTER, MASS.—At the annual meeting of the Worcester Electric Light Company, held Oct. 10, the following officers were elected: Augustus B. R. Sprague, president; Herman H. Fairbanks, secretary and treasurer; William H. Coughlin, superintendent. The directors are: B. B. Sprague, Theodore C. Bates, Josiah Pickett, George T. Dewey, Otis E. Putman, William H. Coughlan, Frank L. Coes, Herbert H. Fairbanks, and John C. MacInnes.

BOSTON, MASS.—At the annual meeting of the stockholders of the Edison Electric Illuminating Company, held Oct. 9, the board of directors was re-elected without change. The board consists of Charles W. Armory, Robert Bacon, Walter C. Baylies, Everett W. Burdett, I. Tucker Burr, Henry B. Cabot, T. Jefferson Coolidge, Jr., George Dexter, Charles L. Edgar, Frederick P. Fish, George S. Silsbee and C. Minot Weld. Henry B. Cabot was relected as treasurer, and J. Otis Wardwell, clerk. At the directors' meeting immediately following, president Charles L. Edgar and vice-president Walter C. Baylies were re-elected, as were also the executive committee, consisting of Messrs. Baylies, Burr, Dexter and Weld.

BURLINGTON, N. J.—At a meeting of the Burlington Electric Light & Power Company, held Oct. 8, the following officers were elected: Griffith W. Lewis, president; George Allison, vice-president; Thomas Daniels, treasurer; Theodore Ellis, secretary. The directors are Nathan Haines, G. W. Lewis, Thomas Daniels, George Allison, Theodore Ellis, George Anthony, Forrest Curl, William Fry and James O. Glasgow.

New Industrial Companies.

THE X. L. MACHINE & ELECTRIC COMPANY, of New York, N. Y., has been incorporated with a capital stock of $10,000. The directors are A. V. Schrade, S. F. Forman and W. A. Swan.

THE WORCESTER ELECTRIC CONTRACT COMPANY, of Worcester, Mass., has been incorporated, with a capital stock of $10,000, by Clarence W. Hobbs, Jr., Roger T. Morris and Lamson Allen.

THE CONNECTICUT ELECTRIC COMPANY, of Williamntic, Conn., has been formed by Frank L. Ferguson and Harry E. Potter. The company will open an office in the Tilden Block and engage in general electrical jobbing.

THE AMERICAN ELECTRIC SWITCH COMPANY, of Springfield, Mass., has filed a certificate of incorporation, with a capital stock of $10,000. The directors are Charles F. Munder, president and treasurer, and John M. Sullivan.

THE KIMBLE ELECTRIC COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000, for the purpose of manufacturing machinery. The incorporators are August Kimble, Alfred W. Craven and E. M. Madden.

THE EATON CHASE COMPANY, of Norwich, Conn., has filed articles of incorporation with the Secretary of State. The company will do a general wholesale and retail hardware business and electrical contract engineering work. The authorized capital stock is $75,000. The incorporators are Herbert B. Cary, Frederick H. Cary and Shepard B. Palmer.

THE HURCK MOTOR & CYCLE COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of $5,000. The object of the incorporation is to manufacture, buy, sell and repair automobiles and other vehicles. The incorporators are: John Hurck, Alfred J. Carpenter, Maud Hurck and Mary H. Carpenter.

THE AKRON HIGH POTENTIAL PORCELAIN COMPANY, of Akron, Ohio, has been incorporated with temporary capital stock of $1,000. The company, when organized, will have paid-in capital stock of $100,000. The incorporators are: M. Otis Hower, George H. Kile, Samuel Kile, A. L. Dike and H. E. Andress. The company will manufacture high tension and other insulators. The company has purchased the old pottery plant at Barberton, which is being equipped for its work. It is expected that the plant will be started within 30 days. A. L. Dike will be superintendent of the company.

New Incorporations.

PRAIRIE GROVE, ARK.—The Praire Grove Telephone Company has filed articles of incorporation with the Secretary of State, with a capital stock of $6,000. The officers and incorporators are E. G. McCormick, president; W. T. McCormick, treasurer, and W. M. Collins, secretary.

ALGONA, IA.—Articles of incorporation have been filed with the Secretary of State by the Algona Telephone Company, with a capital stock of $50,000. The incorporators are W. K. Ferguson and others.

PETROS, TENN.—The Petros Electric Light Company has been chartered here by A. H. Wood, C. J. Jackson, J. R. Gott, W. H. Nelson and M. W. Burch.

WHEELING, W. VA.—A charter has been issued by the Secretary of State to the Rapid Transit Company of Wheeling to build a railway to commence near the central portion of Wheeling to Seabright's Hollow, Marshall County. The incorporators are Albert M. Schenk, A. S. List, James V. Braden and George P. Colmar, of Wheeling, and Charles Ogden, of Pittsburg. The company has a capital stock of $1,000,000. It is stated that an option on the old List pork house at Fulton has been secured as a site for the power plant.

SUMNER, WIS.—The Beef River Valley Telephone Company has filed articles of incorporation with a capital stock of $2,000. The incorporators are John Ring and others.

CASHTON, WIS.—Articles of incorporation have been filed for the Cashton Telephone Company by E. Steele and Jorgan A. Moen. The company has a capital stock of $10,000.

KEMMERER, WYO.—The Kemmerer-Big Piney Telephone Company has filed articles of incorporation to construct a telephone line from Kemmerer to Big Piney, in Uinta County, Wyo. The company is capitalized at $5,000.

NEW CASTLE, WYO.—Articles of incorporation have been filed for the New Castle Electric Company, with a capital stock of $30,000, by George E. Getchell and others.

LANGFORD, MAN.—The Union Farmers' Telephone Company has been formed here for the purpose of building rural lines throughout the municipality. The incorporators are: William G. Pollock, James C. Drysdale, Robert Hunter, Walter Brydon, James Dark, Duncan McLaren and John McLaren, all of Langford.

TORONTO, ONT.—A charter has been granted by the Onario Government to the American Machine Telephone Company, Ltd., of Brantford. The company has a capital of $450,000, and is authorized to carry on the general business of a telephone company. The incorporators are H. N. Baker, A. E. Knox, A. H. Paffard, T. E. Moulden and Miss May Rowe, of Toronto.

JORDAN, ONT.—The Niagara District Telephone Company has been incorporated, with a capital of $10,000, to carry on a general telephone business. The provisional directors are: C. Wisner, A. Culp, South Township, Ont., and E. Werner, Clinton Township, Ontario.

INGERSOLL, ONT.—The Ingersoll Telephone Company has been incorporated with a capital of $50,000. The provisional directors are: O. E. Robinson, H. F. Boyce, T. R. Mayberry, of Ingersoll.

Legal.

KILLED AT THE TELEPHONE.—The Supreme Court of Pennsylvania in the suit of Delahunt versus United Telephone & Telegraph Company, has affirmed the decision for the plaintiff. The following are the points of the decision: (1) Where a person was killed by an electric current from a telephone on his premises, the rule "res ipsa loquitur" applies. (2) It is the duty of a telephone company to see that no deadly current passes over its wires, and it is its duty to keep the same properly insulated so that no accident would occur, if it came in contact with a wire dangerously charged. (3) In an action against a telephone company to recover for death of plaintiffs' father while using the telephone, where he was instantly killed on taking the metal transmitter down, plaintiffs were required only to show in the first instance that their father was killed by an electric shock while using the instrument furnished by defendant telephone company to him as a subscriber. (4) Evidence in an action to recover for death of telephone subscriber, killed while attempting to use instrument furnished, *held* not to show defendant guilty of contributory negligence. (5) In an action by children to recover for the death of their father, where the court instructed that if they could recover, the amount of the verdict would have to be limited to compensation to them for loss of what they could have expected from him for their support and education during their minority, a remark of the court that one of the plaintiffs being a deaf mute, the father might have been liable to contribute more to such child's support than he ordinarily would, is not ground for reversal. (6) Where there is evidence of an effort to subpœna a witness, it is within the discretion of the trial court whether his testimony at a former trial shall be admitted in evidence.

Personal.

MR. F. H. THOMSON, of St. John, N. B., has resigned his position as general manager of the New Brunswick Telephone Company.

MR. W. B. ELLISON, head of the New York City department of water, gas and electricity, has been made corporation counsel.

MR. NORMAN MINER has joined the forces of the Bates Advertising Company to represent it in the central station advertisng department.

MR. EARL C. METZGER, recently assistant superintendent of Nelson Morris & Co. Car Works, Chicago, has resigned and has accepted the position of mechanical engineer with the Hicks Locomotive & Car Works, Chicago.

MR. F. H. BEARDSLEY, for several years past superintendent of the Berkshire Electric Company, of Pittsfield, Mass., has resigned and will open an electrical supply store in the old armory building on North Street, that city.

GEN. EUGENE GRIFFIN, first vice-president of the General Electric Company, returned from Europe recently greatly benefitted by a long course of treatment at Carlsbad. He has resumed his duties with renewed strength and vigor.

MR. TYLER GREENE is to be the new electrical inspector at Toledo, O., at a salary of $2,000. He has been the superintendent of the fire alarm telegraphs. The inspector is to have charge and supervision of all interior and outside wiring.

MR. EDGAR VAN ETTEN, a vice-president of the Boston & Albany, has been elected president of the Long Acre Light & Power Company, the control of which, along with the Manhattan Transit Company, was recently acquired by John C. Sheehan and associates.

MR. W. S. COLEMEN has resigned as electrical engineer of the Petaluma & Santa Rosa Railway Company, of Petaluma, Cal., to accept the position of general manager of the Union Traction Company, of Santa Cruz, Cal. This property has been acquired by John Martin and his associates, who recently took over the lighting and gas company in Santa Cruz.

MR. C. F. BAKER, mechanical engineer, has been engaged by Mr. L. B. Stillwell as superintendent of power and construction in connection with the engineering and operating contract which Mr. Stillwell has recently executed with the United Railways & Electric Company, of Baltimore. Mr. Baker is well known to the engineering fraternity and the railway world. He has filled the office of President of the American Street Railway Mechanical & Electrical Association; also of the New England Steam Railroad Club, as well as taking an active part in the New England Street Railway Club. For many years Mr. Baker was with the West End Street Railway Company, of Boston, and the Boston Elevated, in charge of the construction and operation of their power plants and rolling stock. He is regarded as one of the ablest and most experienced, practical men in this line of work.

Trade Publications.

ELECTRIC LIGHT SUPPLIES.—The H. T. Paiste Company, Philadelphia, Pa., has issued price-list No. 7, dealing with electric light supplies.

ATTACHING PLUGS.—The Stanley-G. I. Electric Mfg. Company, Pittsfield, Mass., has issued a folder giving an illustrated description of flush receptacles and attaching plugs.

DIRECT-CURRENT RAILWAY MOTORS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 4461, dealing with the GE-78 railway motor which is rated at 35 hp.

GAS ENGINE MAGNETO-DYNAMO.—The Hercules Electric & Mfg. Company, 707 Langsdale Ave., Indianapolis, has issued a folder describing its Wizard tubular magneto, the armature of which is enclosed in a watertight brass tube.

AUTOMATIC CIRCUIT BREAKERS.—Supply catalogue No. 7602 of the General Electric Company, Schenectady, N. Y., is a 70-page publication giving a price-list of parts of numerous types of direct-current automatic circuit breakers.

FEEDER REGULATORS.—Bulletin No. 4459 of the General Electric Company, Schenectady, N. Y., is a 24-page publication giving a well-prepared technical discussion of the operating characteristics of feeder regulators of the induction type.

MERCURY ARC RECTIFIER.—Price-list No. 5155 of the General Electric Company, Schenectady, N. Y., is devoted to mercury arc rectifiers and rectifier tubes for voltages of from 110 to 330 alternating and for currents of from 10 to 40 amperes direct.

DIRECT-CURRENT MOTORS WITH COMMUTATING POLES.—Bulletin No. 4462 of the General Electric Company, Schenectady, N. Y., gives an illustrated description of variable-speed direct-current motors equipped with commutating poles which give a speed range of 3 to 1. These machines are built in sizes of from 5 to 130 hp.

CORE-TYPE TRANSFORMERS.—The General Electric Company, Schenectady, N. Y., has issued an extremely neat publication, designated as No. 9143, dealing with type H transformers for lighting service. These transformers have recently been improved in efficiency, a fact that is well pointed out by means of diagrams showing the copper and core losses in 1904 and 1906.

MOTORS FOR DRIVING LAUNDRY MACHINERY.—Circular No. 798 of the Stanley-G.I. Electric Mfg. Company, Pittsfield, Mass., gives an outline description of induction motors used for driving laundry machinery. A double-page illustration shows an induction motor mounted on the under side of an extractor, a lower oscillating bearing permitting the motor to gyrate with the extractor.

GENERATING SETS.—Bulletin No. 139, which has just been issued by the B. F. Sturtevant Co., of Boston, Mass., in its "Engineering Series," presents a full line of generating sets driven by direct-connected vertical enclosed engines with forced lubrication. The published list contains 14 sizes, ranging from 3 to 50 kw in output; the former driven by a 3½ x 3 engine and the latter by a 12 x 10. All of the engines were especially designed for generator driving.

POLYPHASE INDUCTION MOTORS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 4464, devoted to skeleton frame polyphase induction motors. These machines are built with squirrel cage secondary windings for use where a large starting current is not objectionable and with polar wound secondaries for use where the voltage regulation in the supply circuit is of importance. The motors of the latter type are provided with extra resistance for insertion in the secondary circuit.

LIGHTING SUPPLIES.—Price-list No. 5154 of the General Electric Company, Schenectady, N. Y., deals with tantalum incandescent lamps and tantalum units. Bulletin No. 3488 gives much information concerning the packing of Edison lamps and standard package quantities. Bulletin No. 4457 contains a price-list of parts of the form B arc head light. Carrier bus bar panels for Brush arc generators are treated at great length in bulletin No. 4463, while bulletin No. 4460 deals with a description and complete price-list of parts of the form 3 luminous direct constant current series enclosed arc lamp, with stationary upper electrode.

News of the Trade.

THE R. R. SIGN COMPANY, of Dayton, Ohio, is erecting a number of large signs for Dayton merchants, several of them having letters over six feet high. The company is now shipping signs to all parts of the country.

ANDERSON LINE MATERIAL.—The firm of R. W. Marshall & Co., of 95 Liberty Street, New York City, has been appointed by Albert & J. M. Anderson Mfg. Co., of Boston, agents for the sale of Anderson line material.

THE RAIL JOINT.—The Rail Joint Company, 29 West Thirty-fourth street, New York City, and Troy, N. Y., where considerable extensions of its plant have been made recently, is the manufacturer of various types of insulating rail joints to meet different requirements and conditions, as well as of standard sections for ordinary track work. Its "Continuous Compromise" or step rail joint is designed to connect different sections of T rails, also T and girder rails, giving perfect rail alignment. It is made of the best quality cast steel to fit any sections, and is exclusively the production of this company.

AUTOMATIC TESTING AND RESETTING PLUG.—In the ordinary test of a telephone line there is nothing to indicate that the heat coil is short-circuited as the circuit is completed and the line seems to test O. K. Therefore, in order to give proper protection to the apparatus of a system it is essential to have some means of determining whether a heat coil is short-circuited or not, hence the need of the testing and resetting plug, which has been devised by Mr. Frank B. Cook for use in connection with all self-soldering protectors, to insure proper protection of the system. Mr. Cook will be very glad to send his circular describing the new automatic electrical testing and resetting plug to exchange managers who have installed self-soldering protective apparatus, upon request at 240 West Lake Street, Chicago, Ill.

USES OF VOLTAX.—One of the latest paints to be used as a waterproofing material for concrete blocks is Voltax, which is now being made in the form of a colorless liquid compound to take the place of the ordinary waterproof paints and similar preparations. The Electric Cable Company, of 17 Battery Place, New York, have filled a large number of orders for this compound to be used in this manner. Voltax is also being extensively used to prevent the wet concrete from sticking to the metal plates of block-making machines. It is applied to the metal plates before the concrete is poured into the mold. The results are said not only to keep the face plates free from adhesions, but to add materially to the waterproofing qualities of the concrete block.

THE LIGHTING OF PUBLIC BUILDINGS.—Time was when whatever pride we had in our public buildings was due mostly to their massive proportions. With a few notable exceptions any claim to architectural beauty or convenience for the transaction of public business would have been thought a jest. With material prosperity has come, however, the ability and willingness for cultivation of the artistic, and popular feeling is in favor of allowing only architects with established reputation to handle public works. Not the least of the objectionable features in the oldest buildings was the lighting, but under the new order this detail has had the same careful thought as have the other electrical problems. We note the use of Frink reflectors especially designed to meet unusual conditions in such recently completed work as the Essex County Court House, Newark, N. J., Hall of Records, Brooklyn, and Hall of Records, New York. These reflectors designed and manufactured by I. P. Frink, 551 Pearl Street, New York, form a part of "The Frink System," a recognized solution of difficult illuminating problems.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCT. 9, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

832,610. PERMANENTLY PLIABLE AND ADHESIVE COMPOUND FOR INSULATING AND OTHER PURPOSES. Robert L. Johnstone, Glenridge, N. J. App. filed May 14, 1903. A permanently pliable and adhesive compound consisting of gutta-percha resin and a waxy substance having a relatively high melting-point.

832,612. METHOD OF INSTALLING ELECTRIC OUTLETS AND FIREPROOF WALLS AND PARTITIONS CONTAINING THE SAME. Louis Kalischer, Brooklyn, N. Y. App. filed Sept. 25, 1903. A supporting arm is built into the wall or partition so as to extend along the same, and outlet connections are provided in said arm or bar at suitable points, the partition being afterwards built around the arm and outlet.

832,632. MULTIPLE CONTACT FOR ELECTRICAL CONDENSERS; John F. Skirrow, East Orange, N. J. App. filed Mar. 14, 1905. A multiple contact condenser by which the line may be connected to groups of inductive sheets or plates one after the other, in order that as many of said sheets may be charged as desired.

832,642. MAGNETIC ORE SEPARATOR; Henry H. Wait, Chicago, Ill. App. filed Mar. 20, 1905. A magnet has a cylindrical armature rotating between the pole pieces on a vertical axis, and the ore is allowed to drop between said pole faces and the armature so as to be deflected by the rotation.

832,652. RAILWAY BLOCK SIGNAL SYSTEM; Abram L. Bower, Boyertown, Pa. App. filed Oct. 22, 1902. Has signal lamps along the track and in the locomotive cab which are adapted to be operated by the passage of the train over successive block sections, the rails being insulated from one another between the sections.

832,653. ELECTRICALLY DRIVEN FLUID MOTOR; Gaston A. Bronder, Brooklyn, N. Y. App. filed Feb. 12, 1903. A pressure system in which an electric motor is utilized to compress air into a reservoir and from which the air may be utilized in an engine whenever desired, exhausting into a second tank at pressure above atmospheric.

832,705. CIRCUIT BREAKER; Samyel N. Stewart, Jr., Schenectady, N. Y. App. filed Mar. 20, 1905. Relates to street railways where a circuit breaker of large capacity is located at a point distant from the motorman and usually beneath the floor of the car. Relates to a mechanical construction by which the breaker is made more rigid and compact.

832,709. APPARATUS FOR INSURING SAFETY OF TRAFFIC ON SINGLE LINES OF RAILWAY; Edward Tyer, Dalston, England, and James H. Hamilton, Cape Town, Cape Colony. App. filed Jan. 5, 1904. An indicating apparatus having a pair of steel magnets each surrounded with a magnetizing coil, one coil being influenced by outgoing currents and the other by incoming currents. Designed to show "tablet in" and "tablet out" in a staff system.

832,712. TROLLEY; Henry West, Galesburg, Ill. App. filed July 20, 1903. The trolley wheel is bushed onto a stationary axle having a drum on which spring blades, attached of the trolley wheel, bear. The harp is capable of lateral yielding movement.

832,713. ALTERNATING-CURRENT MOTOR; John B. Wiard, Lynn, Mass. App. filed Feb. 23, 1904. In an electric motor, the combination with the motor-armature, of a magnetically-operated switch located adjacent to one end thereof, and a magnetically-actuated member for operating said switch located at the opposite end of said armature.

832,718. ELECTRIC RECEPTACLE; Charles A. Chase, Chicago, Ill. App. filed Apr. 29, 1905. A receptacle having two bushings joined by a threaded shell. Adapted for use with a sheet metal support such as interior signs and out-door decorations.

832,720. LIQUID RHEOSTAT; George W. Cravens, Schenectady, N. Y. App. filed Oct. 21, 1905. A body of liquid is contained between two conical pans which are axially movable toward one another. The pans are diametrally divided and a partition in the resistance fluid extends upward in such device.

832,724. ALTERNATING-CURRENT MOTOR; Friedrich Eichberg, Berlin, Germany. App. filed Jan. 12, 1905. In an alternating-current motor of the commutator type, a manetizing-winding connected to a source of current, a transformer having its primary in series therewith, an inducing-winding displaced from the first winding and connected to the secondary of said transformer, and a short-circuited winding in inductive relation to the inducing-winding and relatively movable thereto.

832,729. AUTOMATIC UNLOCKING DEVICE FOR SWITCH MECHANISMS; John D. Hilliard, Jr., Glens Falls, N. Y. App. filed Apr. 20, 1904. A device for automatically throwing three-phase alternators into step with the line. A magnetic circuit closer is tripped into action when a transformer across two of the line wires has its circuit closed by a connection from the alternator to be thrown in.

832,730. INCANDESCENT ELECTRIC LAMP; Harry C. Hubbell, Jersey City, N. J. App. filed Jan. 26, 1905. A glass bulb contains a platinum filament and is suspended between a pair of wire hooks in such a way that the two sections hang downward when the bulb breaks.

832,741. REPULSION-MOTOR CONTROL; Maurice Milch, Schenectady, N. Y. App. filed Apr. 30, 1904. The method of improving commutation of a repulsion-motor at speeds above synchronism, which consists in reducing the electromotive force impressed on the primary member, and impressing a compensating electromotive force on the secondary member.

832,742. UNIPOLAR ALTERNATING-CURRENT MACHINE; Jakob E. Noeggerath, Schenectady, N. Y. App. filed Mar. 17, 1905. An alternating-current motor dynamo-electric machine, comprising a field structure arranged to produce a unipolar field, a field-winding adapted to be connected to a source of alternating current, and a plurality of armature-conductors arranged to be traversed by the flux of said unipolar field and relatively movable thereto, said field structure being laminated in planes parallel with the armature-shaft.

832,745. MOTOR CONTROL; Jesse S. Pevear, Schenectady, N. Y. App. filed Aug. 10. 1904. Relates to the changing of the circuits of a car motor which sometimes runs on an alternating current from a transformer and sometimes from a direct current. The arrangement is such that switches can be thrown simultaneously.

832,746. TELEPHONE-CIRCUIT; Wilton W. Phillips, Ventura, Cal. App. filed Feb. 20, 1906. The talking circuit at each station includes a relay having a pair of armatures and a supplemental circuit having a relay with a single armature whereby the supplemental circuit at any substation renders inoperative the talking circuit at such substation when any other circuit is operating.

832,747. ELECTRIC CLOCK WINDING MECHANISM; George H. Rupley, Schenectady, N. Y. App. filed July 14, 1905. The clock mechanism has a cam which trips a switch to start the rewinding motor after the clock spring has unwound a predetermined amount.

832,748. ELECTRIC SWITCH; Howard R. Sargent, Schenectady, N. Y. App. filed Apr. 12, 1902. A switch blade is thrown by a sliding link connection and a spring impelled plunger is effective to insure an abrupt movement to break the circuit.

832,765. TROLLEY WHEEL AND SUPPORT; Big G. Young and Charles N. Pickering, Cedargrove, W. Va. App. filed Nov. 13, 1905. The tread portion of the trolley wheel is made in the form of a separable disc so as to be renewable when worn.

832,767. ELECTRICALLY TREATING AIR OR OTHER GASES; James H. Bridge, Philadelphia, Pa. App. filed Apr. 3, 1906. An arrangement for causing the gas to pass through perforations in minute streams in the path of a silent brush discharge.

832,768. ELECTRIFIER FOR TREATING AIR OR OTHER GAS; James H. Bridge, Philadelphia, Pa. App. filed May 25, 1906. An electrifier, consisting of electrodes provided with an inlet and outlet for air or other gas to be treated by passage therethrough, a conductor for each of said electrodes, one of said conductors having means and a fuse arranged therein, said means adapted when said fuse is destroyed by an excessive electric current passing therethrough to prevent entrance of air or other gas into said electrodes.

832,820. MAGNETIC SEPARATOR; Frederick T. Snyder, Oak Park, Ill. App. filed Dec. 20, 1902. In a magnetic separator, the combination with a magnet, of means for causing within the field of said magnet a relative differential reciprocating movement between materials to be separated and said magnet, and means for causing the energization of said magnet during the movements in one direction and the de-energization of said magnet during the movements in the reverse direction.

832,821. MAGNETIC ORE-SEPARATOR; Henry H. Wait, Chicago, Ill. App. filed Mar. 9, 1905. In a magnetic separator, the combination with a horizontal rotating magnetic cylinder having permeable projections at its periphery, of a magnet-pole under said cylinder, and a conveyor passing obliquely across the air-gap between said pole and said cylinder, whereby magnetic material fed upon said conveyor is diverted, substantially as set forth.

832,822. MAGNETIC ORE-SEPARATOR; Henry H. Wait, Chicago, Ill., and Frederick T. Snyder, Oak Park, Ill. App. filed Mar. 9, 1905. Relates to modifications of the above.

832,823. MAGNETIC ORE-SEPARATOR; Henry H. Wait, Chcago, Ill. App. filed Mar. 20, 1905. Additional modifications.

832,84. MAGNETIC ORE-SEPARATOR; Henry H. Wait, Chicago, Ill. App. filed Mar. 20, 1905. A still different form of the above.

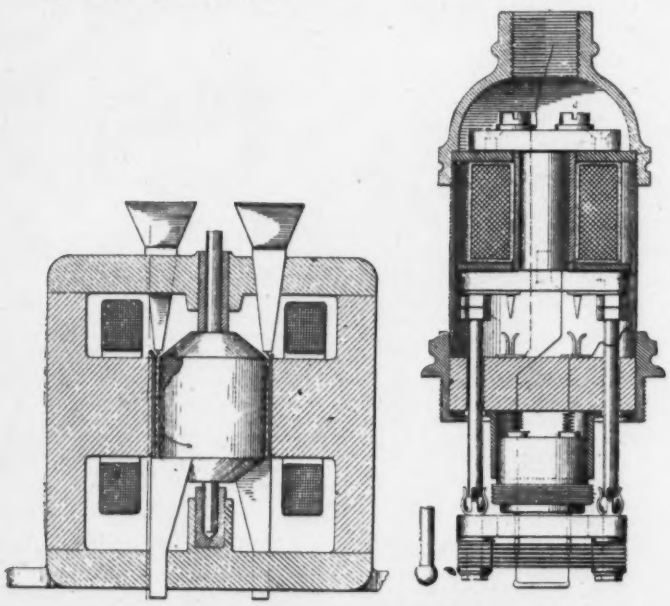
832,824. MAGNETIC ORE-SEPARATOR; Henry H. Wait, Chicago, Ill. filed Mar. 20, 1905. In a magnetic separator, the combination with an annular armature composed of concentric, radially-superposed laminæ or bands, of a magnet having opposed poles between which said armature is adapted to be relatively rotated, and means for passing material to be separated between the laminated surface of said armature and one of said magnet-poles.

832,826. MAGNETIC ORE-SEPARATOR; Henry H. Wait, Chicago, Ill. App. filed Mar. 20, 1905. In a magnetic separator, the combination with a revolving magnet tapered from approximately its axial center to its periphery to form a wedge, of a magnet-pole tapering at its end, with the edge thereof in proximity to the edge of said revolving magnet and at an angle thereto, and means for feeding material to be separated into the gap between the edges of said opposed magnets.

832,827. MAGNETIC ORE-SEPARATOR; Henry H. Wait, Chicago, Ill. App. filed March 20, 1905. In a magnetic separator, the combination with an armature, of a shield of non-magnetic material inclosing said armature, said armature being rotative relative to said shield, a magnet-pole facing said armature, a non-magnetic shield for said pole of greater thickness than said armature-shield, and means for passing material to be separated between said shields.

832,828. MAGNETIC ORE-SEPARATOR; Henry H. Wait, Chicago, Ill. App. filed Mar. 20, 1905. Relates to a slightly modified construction.

832,829. MAGNETIC SEPARATOR; Henry H. Wait, Chicago, Ill. App. filed Apr. 24, 1905. In a magnetic separator, an element having a magnetic attracting-surface provided with a number of approximately pyramidal projections each composed of a plurality of teeth of progressively different heights.



832,642.—Magnetic Ore Separator. 832,934.—Electric Glow Lamp.

832,847. LOCK FOR SIGNALS; Fred B. Corey, Schenectady, N. Y. App. filed Feb. 7, 1906. A device for preventing semaphores falling to clear by the weight of sleet and snow with which they are sometimes encrusted. A latch is effective to hold the semaphore at danger until released by an electric circuit.

832,852. SYSTEM OF DISTRIBUTING ELECTRICITY BY ALTERNATING CURRENTS. William M. Fairfax, Brooklyn, N. Y. App. filed July 18, 1892. The combination of a source of alternating currents of approximately constant quantity, a transformer supplied from said source, and a phase-advancing device connected to the secondary circuit of said transformer.

832,862. MEANS FOR INSTALLING ELECTRIC OUTLETS; Louis Kalischer, Brooklyn, N. Y. App. filed Oct. 1, 1903. Relates to the apparatus covered by the method of patent No. 832,612.

832,876. CONNECTOR FOR TELEPHONE AND OTHER WIRES; Charles L. Peirce, Jr., Chicago, Ill. App. filed May 31, 1905. A connector for telephone and other wires comprising a clamping member having substantially parallel sides, a plate of conducting material inserted between the sides of said clamping member, and means for drawing the sides of said clamping member together upon the wires whereby to clamp the latter against the opposite sides of said conducting-plate, substantially as described.

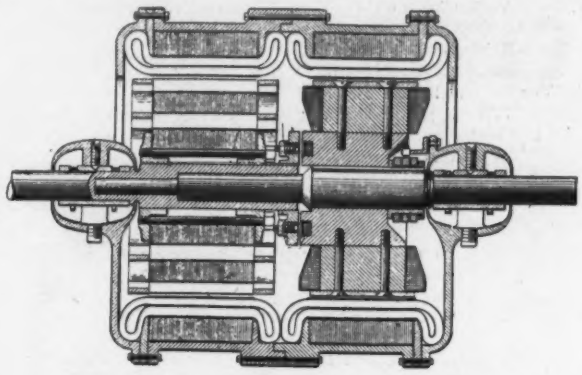
832,912. RHEOSTAT; Fred R. Kunkel, Wilkinsburg, Pa. App. filed June 12, 1905. The resistance wire is wound on a circular porcelain block having lips first on one side and then the other, so as to be readily moulded.

832,913. FAN MOTOR ADAPTER; Fred R. Kunkel, Wilkinsburg, Pa. App. filed Aug. 2, 1905. Means for adapting a bracket to be mounted either in alignment with its base or at an angle of substantially 90° therewith, and particularly means for adapting a relatively small electric motor for mounting in either a vertical or a horizontal plane.

832,926. MULTIPLE UNIT SWITCH CONTROL SYSTEM; Francis H. Shepard, New York, N. Y. App. filed Feb. 12, 1904. Relates to a method of controlling motors which obviates interruption of the motor circuits between starting and full running positions, and all abrupt changes in torque and speed.

832,934. ELECTRIC GLOW LAMP; John Van Vleck, New York, N. Y. App. filed May 9, 1899. The filament for heating the glower is normally depressed so as to closely surround the same, but is drawn upward by a magnet when the glower becomes luminous.

832,946. AUTOMATIC RELEASE FOR PARTY-LINE EXCHANGES; Clarence A. Anderson, Salina, and William Hagstrom, Lindsborg, Kan. App. filed Feb. 8, 1905. In the central-office apparatus of a party-line exchange, a jack and plug for connecting a party-line to the central-office devices, a battery, and automatically-operating means for sending a prolonged releasing impulse over the line upon a withdrawal of the plug from the jack.



833,051.—Electromechanical Transmission Device.

832,947. IGNITER FOR CIGAR LIGHTERS; George S. Andrews, Butler, Pa. App. filed Sept. 11, 1905. A torch has a flexible wire connection with the support and a circuit is completed to ignite the torch by sliding over a number of fixed contacts.

832,951. SUSPENSORY DEVICE FOR ELECTRIC LAMPS; Samuel R. Bell, Tuscaloosa, Ala. App. filed Sept. 19, 1905. The lamp depends from a flexible cord wound around a drum which has a main spring secured thereto for drawing the cord upward.

832,983. ELECTRODE FOR USE IN THE MANUFACTURE OF BLEACHING LIQUOR; Richard Kother, Cunewalde, Germany. App. filed Nov. 3, 1905. Electrolytic apparatus for the manufacture of bleaching liquor comprising compartments separated by non-conducting partitions, a single electrode arranged horizontally in each non-conducting partition and projecting on either side thereof in such manner that each two adjoining half-electrodes lie horizontally one above the other forming a step-like arrangement of the electrodes, the lower electrode portion in each compartment acting as an anode and the projecting half of the next electrode situated above it acting as a cathode.

833,017. ELECTRIC RAILWAY; Miles E. Bailey, Washington, D. C. App. filed May 27, 1905. A toy electric car adapted to reverse itself at the end of its movement on a straight track. Has a depending tappet with a link connection to a switch arm.

833,020. INSULATED RAIL JOINT; William F. Bossert, Utica, N. Y. App. filed Jan. 11, 1906. The fish plates are separated from the rail by an insulating sheet which wholly surrounds the sides and base thereof. The plates have insulated bushings.

833,034. AEROPHORE; Lee de Forest, New York, N. Y. App. filed Dec. 8, 1905. An aerophore comprising means for emitting a predetermined electro-magnetic wave-signal in a predetermined direction and means for emitting a signal identifying the location of the aerophore.

833,051. ELECTROMECHANICAL TRANSMISSION DEVICE; Arthur W. Harrison, Los Angeles, Cal. App. filed June 12, 1905. A casing contains a dynamo and a motor in co-axial arrangement with one another and a controller is effective to produce different speed and power factors, and also to positively clutch the two armatures together for direct drive.

833,080. TROLLEY; Elijah D. McDonald, Los Angeles, Cal. App. filed Nov. 28, 1905. The side members of the trolley harp are beveled so that when the wheel leaves the wire and strikes against guy wires, etc., the bearings will not be injured.

833,125. ELECTRIC SYSTEM FOR OPERATING BULKHEAD DOORS, HATCHES, ETC.; William B. Cowles, Cleveland, O. App. filed July 11, 1904. The bulkhead door has a rack and is closed by worm shaft driven by an electric motor. The worm shaft has spring thrust which opens the motor circuit in case excessive resistance is encountered.

833,129. ELECTRIC CONTROLLER AND STARTING SWITCH; John B. Duckitt, Hyde, England. App. filed Nov. 4, 1905. Relates to improvements in electric controllers and starting switches of the face plate type. A plurality of iron horns project upward adjacent to the contacts so as to mechanically blow out the arcs drawn.

833,135. HIGH TENSION TERMINAL FOR SPARK COILS; Edward B. Jacobson, Pittsfield, Mass. App. filed Feb. 7, 1906. A form of terminal for connecting the secondaries of induction coils for motor vehicles. The end of the wire has a thimble or cap which engages a spring plunger.

12,538. ELECTRIC CONTROLLER; Charles H. Keeney, Milwaukee, Wis. App. filed Mar. 30, 1904. A single solenoid and its reciprocating core and a series of devices moved by the core for successively cutting out a new unit of resistance mechanically each time the solenoid is energized.

12,541. TELEPHONY; Harry O. Hugh, Chicago, Ill. App. filed Oct. 20, 1905. In a telephone system, the combination with a metallic circuit employed in uniting telephone-substations for conversation of grounded telephone-lines including the sides of the said circuit in parallel, and means at each exchange end of said circuit controlled by the respective exchange operator for compensating for difference in resistance between the sides of the said metallic circuit, whereby to prevent cross-talk, substantially as described.